NEW MEXICO ABANDONED MINE LAND PROGRAM

COUNTY ROAD A-25 SUBSIDENCE

COLFAX COUNTY, NEW MEXICO

SITE CHARACTERIZATION AND MITIGATION RECOMMENDATIONS REPORT

January 10, 2023

Project #: 01A-003-002

SUBMITTED BY: Trihydro Corporation

1252 Commerce Drive, Laramie, WY 82070

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CERTIFICATE OF ENGINEER

I certify that the County Road A-25 Subsidence, Site Characterization and Mitigation Recommendations Report, which includes reclamation and safeguarding alternatives, engineering designs, and cost estimates, was prepared by me or under my direct supervision in accordance with Professional Services Agreement Share No. 19-521-0620-0180, and to the best of my knowledge is true and correct.

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1.0 INTRODUCTION

The New Mexico Energy, Minerals, and Natural Resources Department, Abandoned Mine Land Program (AML) was notified of active subsidence features in and adjacent to Colfax County Road A-25 (A-25) by the Colfax County Road Department in the fall of 2021. The features are located approximately 9 miles northeast of Raton, New Mexico (Figures 1 and 2) in an area with numerous historic coal mines. The land ownership near the features is noted in Figure 2. There are two known abandoned mine adits on either side of A-25 (Figures 2 and 3). The site is steeply sloped and rocky with dense stands of scrub-oak, making access to areas adjacent to A-25 difficult.

AML, Colfax County, and Trihydro Corporation (Trihydro) representatives visited the site on October 22, 2021, to determine the best approach for characterizing the site. Following the site visit, AML issued Task Order 3 to Trihydro to investigate the active subsidence areas and determine if the subsidence is related to historic mining activity.

Under Task Order 3, Trihydro reviewed historical records and reports and performed site surface and geophysical investigations to determine if mapped abandoned underground mine workings are beneath the potential subsidence features. The findings and recommendations for A-25 are provided in this report.

2.0 PROJECT RECORD REVIEW

Trihydro reviewed documents provided by AML which guided the field investigation and the recommendations in this report. Reports provided by AML included numerous (over 70) memos from R. B. Nickelson to Steve Frost pertaining to underground mining in the area (Nickelson, n.d.), a memo from R. Armijo to AML staff that lists USGS quadrangle maps and mines in each quadrangle (Armijo, 1991), and a report on inactive coal mines in Colfax County (Hoffman, 2015).

Trihydro also reviewed information in the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) Coal Mine Database, available from: https://maps.nmt.edu/ (NMBGMR n.d.) to address specific safety and environmental safety concerns related to future development (e.g., urban growth).

Additional documents provided by AML included mapping with historical mine locations (NMBGMR n.d. a, b, and c), Raton basin geology and coal districts and mine locations (Hoffman 2015), and underground workings for the Turner Mine (NMBGMR n.d.c). The Turner Mine underground workings were particularly helpful as, when georeferenced, adits aligned with adits identified in the field (Figure 3). Trihydro made further fine adjustments to the Turner Mine underground workings map to align the mapped coal seam outcrop with visible outcropping and coal slack piles from the satellite imagery (Figure 3).

Trihydro located several documents that aided in understanding mining in the area. The documents included a bulletin on Raton coal field coal resources (Lee, 1924), a paper on Raton coal field commercial coal beds (Pillmore, 1976), and NMBGMR Resource Map 10 (NMBGMR, 1978).

2.1 FINDINGS

The document review highlights the long and rich mining history of the coal beds east of Raton. The Nickelson memos, in particular, narrowed the potential mines that could contribute to the subsidence features to the Denton Mine (pp. 118-120), the Turner-Urtado Mines (pp. 164-167), and the Yankee Mines (pp. 168-173) (Nickelson, n.d.).

The Denton Mine operated between 1931 and 1960 just northeast of the Turner-Urtado Mines. The Denton Mine consisted of an adit east of A-25 and two air course holes, one 75 feet (ft) north of the adit and the second about 450 ft north of the adit (Nickelson, n.d.). Based on the adit and air course configuration, mining likely progressed west and north.

The Turner-Urtado Mines were mined between 1921 and 1963 and located northeast of the Yankee Mines and just west of A-25 and Denton Mine. The Turner-Urtado Mines included at least three adits, all of which were west of A-25. Nickelson observed that the Turner-Urtado mine was completed with room and pillar mining techniques. Nickelson also describes that “a squeeze developed from the adjoining Denton Mine” in 1937; thereafter, mining at the Turner-Urtado Mines was confined to the first west entry. Historic documents revealed that the Turner-Urtado and Denton mines were connected, but the extent of that connection is unknown. The main adit was located by a hole, 7 ft by 4 ft, and at a depth of 20 ft. An air course 275 ft to the west of the hole was also at a depth of 20 ft. From this description, mining likely intersected with the Denton Mine underneath what is now County Road A-25; however, the exact location is unknown.

The coal seam mined by the Turner-Urtado Mines has a dip direction of 336 degrees (north-northwest) and a dip of 2 degrees (3.5%). The dip direction and dip were calculated based on cross sections from the NMBGMR n.d.b. and notes on the Turner-Urtado Mines from Nickelson. Projected depths to the mine workings within this seam can be seen in the cross section on Figure 4.

The Yankee Mines, also constructed using room and pillar mine techniques, were a complex of coal mines northeast of Raton that were mined from 1905 to 1921 (Nickelson, n.d.) in the Yankee coal bed. The Yankee bed had a reported thickness of 5.5 ft (NMBGMR, 1978). Initially, the Yankee Mines were considered as a potential contributor to the subsidence area. However, the Yankee Mines are approximately 1,200 ft south and west of the A-25 subsidence area. Consequently, the subsidence features are potentially associated with the Turner-Urtado and Denton Mines (Figure 3).

Other findings of note from the records review include:

- The A-25 area is located in the Raton Basin, and the Denton, Turner-Urtado, and Yankee Mines likely extracted coal from the Yankee, Kellog, and Reynolds coal beds (Lee, 1924).
- These coal beds comprise the eastern limit of the Raton Basin and are thinner and less extensive than other beds in the area (Pillmore, 1976).

3.0 SITE CHARACTERIZATION

Trihydro conducted a site investigation from December 1st, 2021, to December 3rd, 2021, of the area surrounding the A-25 subsidence features. The site investigation included a visual investigation of the surface topography in the areas near the A-25 subsidence features and the known Denton Mine and Turner-Urtado Mine adits. Trihydro, and their subcontractor Ground Penetrating Radar Systems Inc. (GPRS), also conducted a geophysical investigation along the alignment of A-25 through the subsidence feature area as well as above and below anticipated mine workings elevations.

3.1 SURFACE INVESTIGATION

Trihydro initially visited the A-25 Site on October 22, 2021, with AML and Colfax County Representatives. Trihydro mapped three distinct subsidence features using hand-held GPS equipment. The two smaller subsidence features each measured approximately 4 inches (in.) by 4 in. with a measured depth of 8 in. The largest feature measures approximately 14 in. by 8 in. with a measured depth of 8 ft.

The subsidence features were measured once again on December 3rd, 2021, as part of the surface and subsurface site investigation. This measurement determined that the two smaller features had grown only slightly in size. A fourth feature was also noted during the investigation and was similar in size to the two smaller features already mapped. The largest feature had grown significantly, most likely from the freeze-thaw cycle as there had been only minimal precipitation at the site. The largest feature measured approximately 28 in. by 11 in. with a measured depth of 15 ft.

On February 16th, 2022, Trihydro once again visited the site and measured the subsidence features. The largest feature grew slightly, measuring approximately 30 in. by 12 in. and the depth of the feature remained the same. Two of the three smaller features remained the same size, with one of the smaller features doubling in length to 8 in. but kept the same width. Trihydro believes that the continued growth of the subsidence features is due to the freeze thaw cycles typical of this time of year in New Mexico as well as precipitation over the winter months. Vehicle traffic may also play a part in the expansion of the features. Photos of the features from each of the three site visits can be found in Appendix C.

Trihydro performed a surface investigation of the areas surrounding the A-25 subsidence area on December 1, 2021. The investigation area ranged from 100-200 ft off the centerline of A-25 and covered approximately 12 acres. A Trihydro engineer conducted a visual inspection of the surface investigation area by walking a back-and-forth pattern over the site. Several locations within the survey area were difficult to access due to heavy vegetation growth and steep topography. In those areas, Trihydro personnel worked to get a higher vantage point to assess the immediate surrounding area for mine features. The focus of the surface investigation was to evaluate the area for additional openings, subsidence or otherwise, to potential underground mine workings below. The surface investigation areas are shown on Figure 3.

Special attention was given to drainage swales and other more established drainages within the surface investigation area. No additional vertical openings or subsidence features were noted in the investigation area or within the A-25 alignment. Several abandoned mine features associated with the Denton Mine were located during the investigation including remnant mine facilities (retaining walls, misc. structures); extensive gob piles; an open adit, and debris. Trihydro also mapped and documented a proposed access route to the Denton Mine. Denton Mine features can be found on Figure 3.

On December 3rd, 2021, Trihydro conducted a surface investigation along the former haul/access route from A-25 to the suspected western edge of the Turner-Urtado Mine. Several gob piles were noted along the route. Two open adits were mapped at the Turner-Urtado Mine, including one adit, A-1, within approximately 30 ft of A-25. Adit A-1 is approximately 3 ft by 3 ft and opens to the mine workings. The depth of the adit is approximately 55ft as described in the Bat Conservation International (BCI) report. The A-1 area also contains a small subsidence/vertical opening directly above the adit, approximately 15 ft north of the opening. The subsidence measures 1 ft by 2 ft and was noted as being open to the mine workings in the BCI report. A section of narrow-gauge rail was noted in the adit opening.

A second open adit was discovered approximately 1,200 ft further west of adit A-1. Adit A-2 measures approximately 1 ft by 2 ft and appears to be open to the mine workings. Several gob piles were noted along the access. Adit A-2 can be accessed from A-25 in the same manner as adit A-1. Much of the access to Adit A-2 is passable with moderate improvement except for a short section immediately west of adit A-1. Steep gob piles through that area may prove difficult to traverse with equipment without extensive improvement. Adits A-1 and A-2 can be found on Figures 2 and 3.

3.2 GEOPHYSICAL INVESTIGATION

GPRS performed a ground penetrating radar (GPR) and electromagnetic induction (EMI) geophysical investigation to map voids along a 600 ft section of the A-25 alignment. Trihydro developed a geophysical workplan and submitted to the AML on November 30, 2021. The work plan detailed the proposed scanning area and methods.

The subsurface investigation took place between December 2nd and 3rd, 2021 and again on May 26, 2022 (EMI only). The mapping area began on A-25 at approximately the same elevation as the southeast Turner-Urtado mine adit (A-1) and extended to approximately 100 ft in elevation above the Denton Mine adit (A-3). The mapped surface area for the geophysical investigation was approximately 10,000 square feet. The width of the GPR/EMI mapping was constrained to the width of the road due to heavy vegetation, steep slopes, and rock outcroppings outside of the road alignment. The GPR/EMI mapping area is shown in Figure 3.

GPRS personnel employed several scanning methods. A brief discussion of those methods is found below,

- 350/400 MHz Antenna: The 350/400 MHz antenna was used to locate near-surface voids. The antenna is mounted in a stroller frame and rolls over the surface which needs to be reasonably smooth and unobstructed in order to obtain readable scans. Depths provided should always be treated as estimates as their accuracy can be affected by multiple factors (material, depth of features, topography, etc.).
- 200 MHz Antenna: The 200 MHz antenna was used to penetrate deeper into the subsurface to detect large voids and anomalies. The increased penetration depth of the 200 MHz antenna sacrifices the resolution of the data retrieved. Smaller voids may be missed with this method, but larger voids/tunnels/anomalies may be detected if within range. The data retrieved from the 200 MHz investigation was largely unusable due to the lack of resolution.
- Electromagnetic induction (EMI): EMI was used to map deeper voids. EMI instruments contain two sets of coils that are located on opposite ends of the tool. One set of coils is used to transmit a primary magnetic field, which generates an electrical current into the ground. The induced current then generates a secondary magnetic field, which is sensed by the coils in the receiver end of the instrument. The EMI is moved over the surface without coming in contact with the surface, so it is not affected by the terrain. However, EMI results are affected by surface features including vehicles and metals in clothing. Vehicles and unnecessary personnel were moved well out of the area during the EMI survey at the A-25 subsidence area. The data was post-processed and displayed in a color-coded contour map which shows relative changes in conductivity.

The scanning area was laid out, marked, and cleared of obstructions (i.e., rocks or debris that could be removed by hand). GPRS began the survey with the 350/400MHz antenna on December 2nd, 2021. Detected void boundaries were marked with blue paint. The marked voids are shown on page 5 of the GPRS report dated December 7th, 2021 in Appendix A. Several voids were detected in the immediate area of the A-25 subsidence features. The subsurface voids are shown on page 6 in the GPRS report dated December 7th, 2021, and provided in Appendix A. GPRS was unable to determine the depth to the bottom of the voids or volume of a voids. Only the largest voids were detected.

On December 3rd, 2021, GPRS was able to secure the needed equipment for the 200MHz scan and conducted a scan of the subsidence features area. The 200MHz scan was inconclusive due to the small size of the voids. As there were no voids detected in the 200MHz scan, the data was not included in the GPRS report.

An EMI scan was also completed on December 3rd, 2021. However, GPRS determined the EMI data was corrupted and unusable. Therefore, GPRS conducted a second EMI scan on May 26th, 2022. GPRS used the EMI scanner to conduct a subsurface investigation of the entire proposed road alignment scan area. Photos of the EMI investigation work can be found in Appendix A. The EMI investigation results can be found in the "heat map" depicted on pages 4 – 7 of the GPRS EMI report dated June 2nd, 2022, provided in Appendix A and also shown on Figure 3. The EMI report notes several strong reaction areas throughout the A-25 alignment, particularly along the western edge of the scan boundary. GPRS notes that the strong reaction areas may indicate areas of potential voids or other subsurface objects. The strong reaction areas are called out on Figure 3.

The west shoulder of A-25 is paralleled by a borrow ditch and is closest to the Turner-Urtado Mine. The borrow ditch may contribute to strong reactions in the locations noted. The EMI data does not indicate the presence of voids in the immediate area of the A-25 subsidence features.

3.3 BAT CONSERVATION INTERNATIONAL INVESTIGATION

BCI conducted investigations of the Denton (incorrectly referenced as Yankee in the BCI report) and Turner-Urtado mine workings on November 17th and 18th, 2021. The purpose of the BCI investigation was to determine if the Denton and Turner-Urtado mines were currently, or could be suitable, habitats for bats. The BCI report detailing their findings at the Denton and Turner-Urtado mines is provided as Appendix B.

BCI entered the Denton Mine through the open adit A-1. BCI reported that the Denton Mine workings were fairly extensive, ending in a collapse approximately 274 ft underground from adit A-1. The workings trended in a west-northwest direction and away from the A-25 subsidence feature area. BCI observed 3 Townsend's big-eared bats hibernating in the Denton Mine A-1 adit. BCI designated the Denton Mine working as "good" suitability for bat habitation and recommends a bat-compatible closure to be constructed during the warm season. The BCI investigation of the Denton Mine workings does not provide enough information to determine if the A-25 subsidence feature is directly related to the Denton Mine underground workings.

BCI entered the Turner-Urtado Mine through the open adit A-2. BCI reported that the Turner-Urtado Mine workings were much less extensive than the Denton Mine workings, ending approximately 55 ft underground from adit A-2.

AML reported an open subsidence feature approximately 15-20 ft into the mine workings. Trihydro mapped this open feature during the site surface investigation. BCI also noted that this section of the Turner-Urtado Mine did not show signs of bat habitation and was of moderate suitability for bat habitation. BCI recommends a destructive closure of the A-2 adit during the warm season. The BCI investigation of the Turner-Urtado Mine workings does not provide enough information to determine if the A-25 subsidence feature is directly related to the Turner-Urtado Mine underground workings.

4.0 RECOMMENDATIONS

Through the review of historic mining documents and the surface and subsurface investigations of the A-25 subsidence and adjacent areas, Trihydro believes that the A-25 subsidence features are historic mining related. While there is nothing definitive in the historic documents to tie the subsidence features to historic underground mining in the area, the overall signs, when taken together, show a strong link between the features and historic mining. Trihydro believes that mine workings are about 5.5 ft thick and may be fairly shallow near the A-25 subsidence due to the location of the Turner Mine adit and the 2-degree coal seam dip (Nickelson, n.d.; NMBGMR, n.d.b.).

The Yankee Canyon and Bartlett Mesa area has seen extensive mining throughout the past 150 years. Aerial photography shows gob piles located throughout Bartlett Mesa. The mine map of the Turner-Urtado Mine, included on Figures 3 and 6, shows mine workings that may be in close proximity to the A-25 subsidence features. Historical records review and confirmation of adit A-1 during the surface investigation indicate the Denton Mine workings may also be in close proximity to A-25.

From October 2021 through February 2022, the A-25 subsidence features have shown that they continue to grow in size. The surface investigation near the subsidence features did not show signs of water piping from surface runoff through the sandstone cap rock. Storm water and material associated with the subsidence feature may be traveling to some larger void below. The sandstone cap rock immediately adjacent to the subsidence features shows little weathering. No deflection in the surrounding sandstone was noted.

4.1 SUBSIDENCE RISK EVALUATION

The GPRS EMI survey noted several locations of strong EMI reactions along the west side of the county road alignment. These reaction areas may indicate void space. Currently, there is insufficient data to determine the extents of underground workings or void space. Additional investigation is needed along the alignment of the road in this area of known historic mining to rule out possible subsidence. The additional investigation may be accomplished with the reclamation alternatives detailed in Section 4.2. The road appears stable through visual assessment and under current traffic conditions. However, until the road stabilization is completed, Trihydro recommends Colfax County officials monitor the A-25 road alignment for additional subsidence monthly, at a minimum.

4.1.1 MONITORING AND MAINTENANCE

Trihydro recommends that Colfax County continue to monitor the area for deflection and subsidence monthly no matter which reclamation method is ultimately chosen. Routine and appropriate road maintenance should include installing signage to notify vehicle traffic that there may be road subsidence in the area and directing stormwater runoff away from the subsidence area.

4.2 RECLAMATION ALTERNATIVES

Trihydro recommends that action be taken to limit the continued subsidence of the A-25 features. Reclamation recommendations for the A-25 subsidence area are presented below, and construction details have been developed for the reclamation recommendations. Construction details can be found in the attached figures. Colfax County should continue to monitor the area for deflection and subsidence no matter which method is ultimately chosen.

4.2.1 NO ACTION

In this option, there will be no action taken by the AML to mitigate the A-25 subsidence features. The subsidence features may stabilize over time, and run-off from the road alignment may carry enough sediment to eventually stop the flow of water and material into the void space below. This option could also be exercised if the road owner, Colfax County, wishes to reclaim the features without the assistance of the AML.

4.2.2 POLYURETHANE FOAM AND BACKFILL CLOSURE

The polyurethane foam (PUF) and backfill option involves placing PUF material into the subsidence features to replace the material washed into the void space below. The goal of using the PUF material is to fill more of the void space below and to slow the movement of water through the previously subsided area. The PUF backfill option is most feasible for closing near-surface voids. PUF material will be placed within 4 ft below ground surface, where backfill will transition to a road base material. The PUF may be installed in two different ways. PUF can either be batched in a specialized machine that will stream the material into the void space, or it can be mixed in 1/3 cubic yard (cy) bags and dumped into the openings by hand. Both machine and hand placement will mainly rely on gravity to pull the PUF into void spaces below. The cost estimate developed for the PUF closure type assumes hand placement of PUF.

The upside of using PUF in this application is that PUF will expand further into subsurface void spaces. The downside of using PUF in this manner is that the quantity of PUF is currently unknown as the size of the void space is unknown. The quantity of PUF shown in the cost estimate of this option is an approximation. PUF is much more costly than other backfill materials. A cubic yard of PUF is approximately two times more expensive than a road base or washed rock material and associated haul costs.

In addition to backfill of the subsidence features, care will be taken with the road surface and associated grading. Geotextile, non-woven Geotex 601 or equivalent, will be placed along the road surface to increase the strength of the road surface. Approximately 1 ft of additional, conditioned, road base material will be placed over the geotextile, and compacted using non-vibratory methods such as a smooth drum roller. The road will be graded to facilitate drainage away from the affected areas and water bars will be added upgradient in the road profile to divert runoff to roadside ditches (see Figure 7). Proposed water bar locations can be seen on Figure 5. Trihydro proposes the road improvements extend 100 ft on both sides of the know subsidence feature along the existing road alignment and anticipates that the road work will require approximately 3,000 square feet of geotextile and 120 cy of road base material. A construction detail for the PUF and backfill closure option can be found on Figure 7.

The approximate cost for the PUF and backfill closure option is approximately $24,400. A more detailed breakdown of the cost is found in Appendix D-1. Most of the cost for this option is found in the added stabilization efforts to the existing road. The cost estimate includes time for a transport truck and trailer for equipment mobilization; a motor grader to grade the road profile and install water bars; a rubber-tired backhoe to excavate around subsidence feature locations for PUF installation; an end dump truck to import road base for road stabilization and subsidence backfill; a smooth drum roller for compaction efforts; a water truck for moisture conditioning materials; a Contractor superintendent; and a laborer to facilitate backfill of features with PUF and installation of geotextile materials. Trihydro anticipates the work for the PUF and backfill option will require three days with an experienced contractor. The cost estimate does not provide costs for oversight.

4.2.3 DRILLING AND GROUTING

Trihydro recommends the drilling and grouting option. This option involves drilling the area immediately adjacent to the A-25 subsidence features and areas where related mine workings may impact the road, and injecting grout into the voids beneath and adjacent to the A-25 alignment. The grouting work may take place concurrently with the drilling investigation. The goal of drilling and grouting the A-25 subsidence features is to map the voids under and near the road alignment and to fill those voids with grout to stop additional subsidence in the area and stabilize the road. The drill holes will be spaced every 30 ft along the A-25 alignment with an increased drilling density of every 20 ft around the existing subsidence features (Figure 6). Based on room and pillar findings in the field, some adjustments to the hole locations may be made to encounter more voids. The proposed drilling program includes 31 holes. Based on projections of the mined coal seam, the proposed drilling program includes drilling up to expected mine floor depths of 100 ft. This drilling plan includes approximately 1,938 ft of drilling. The mined coal seam outcrops very close to the southern edge of the surface investigation area and holes drilled on this end will encounter the mined coal seam at very shallow depths.

The grout used will be comprised of three components: water, cement, and sand. Fly ash may be used as an additive to improve flowability if deemed necessary. A somewhat stiff pumping grout with an ordered slump between 4 and 6 inches will be used to focus the placement of the grout underneath the road, rather than attempting to pump grout out through all available void space. These grouted pillars provide local support and require less grouting material. This requires lower pumping pressures than grouting to fill all available connected space, and it eliminates the possibility of grout being pumped through available void space and out of a distant open adit. The compressive strength of the grout will approximate the strength of the surrounding material, approximately 500 pounds per square inch (psi).

The pumping pressure for grout will be dependent on the existing conditions and depth to mine floor. The maximum pressure allowed at the deepest points will be 400 psi at the wellhead. At the shallowest points, the pumping pressure will remain below 250 psi at the wellhead. Laser levels will be used when pumping to monitor for any ground heave while injecting grout. The engineer on site may adjust pressure limits based on existing conditions such as cracking, depth to void space, and observed downhole conditions.

The upside of the drilling and grouting option is that no additional effort is needed to stabilize the road. Additional geotextile and road base is not required for this option. Trihydro recommends that water bars be installed upgradient of the subsidence feature area along the road alignment to move run-off into the roadside ditch. The 30 ft spacing between holes should be narrow enough to encounter open void spaces present underneath the A-25 alignment based on the historical record of the Turner-Urtado Mine room and pillar dimensions and orientation (NMBGMR, n.d.c). The planned holes that continue north along the A-25 alignment, beyond the Turner-Urtado Mine, may encounter void space from the Denton Mine.

The proposed drilling and grouting approach is optimized to address open void spaces. Adjustments to the grout mixture may be made to properly address collapsed areas of tight rubble at or above the mine depth. Larger collapsed areas of rubble, and more tightly packed rubble are more likely to be encountered as the depth to mine workings increases. Grout adjusted for rubble would travel further from the injection site, often away from the road area, and the grout material quantities required would increase due to the increased spread. The downside of the drilling and grouting option is cost. Grouting work and materials can be excessively expensive, especially in remote areas such as the A-25 subsidence features.

Supplemental drilling and grouting may be required over the drilling area in between some of the holes. The supplemental drilling would be guided by the findings of the proposed drilling and grouting plan and would target suspected void spaces that are not addressed by the proposed drilling plan.

The cost for the proposed drilling and grouting option is approximately $173,210 for 31 drill-holes where Trihydro estimates that half of the holes will require grouting. Additional drilling and grouting for supplemental drilling on suspected void space would include approximately 7 drill-holes and would add approximately $44,010 to the proposed drilling and grouting budget. Reducing the proposed drilling and grouting option to 20 drill-holes would reduce the budget by approximately $54,840. A more detailed breakdown of the costs for the proposed and supplemental drilling and grouting is found in Appendix D-2. The scope of the drilling and grouting includes time for a rotary drill rig with grout injection system; transport truck and trailer; contractor superintendent with pickup; water truck; grout pump; concrete truck; laborer; geologist; and reporting. Without including grouting costs, the approximate drilling cost is $44.30 per ft. The proposed drilling and grouting cost also include 200 cy of grout for injection into the void space below, and adjacent to, the A-25 subsidence area. After the drill rig, the grout material cost is the largest line item of the cost estimate. The actual quantity of grout is unknown at this time, so that cost may increase or decrease depending on the size and configuration of potential mine voids beneath A-25. Trihydro anticipates the work for the drilling and grouting option will require fourteen days with an experienced contractor. The cost estimate does not provide costs for oversight.

5.0 ADIT CLOSURES

There are three open adits of concern in the A-25 subsidence area. Adits A-1 and A-2 are associated with the Turner-Urtado mine and adit A-3 at the Denton Mine. Trihydro recommends bat-compatible, culvert type closures for adits A-1, A-2, and A-3, as per guidance from AML.

Trihydro recommends a bat-compatible culvert with a bat gate closure at the Turner-Urtado mine adits A-1 and A-2, and the Denton Mine adit A-3. This closure will provide an entrance for bats to continue to use the Turner-Urtado and Denton Mines as well as provide a landmark noting the existence of nearby underground mine workings. The proposed culvert with the bat closure consists of a 24 in. corrugated metal pipe (CMP) culvert and bate gate with a removable crossbar for further investigation and monitoring of the bat habitat. The vertical opening (VO-1) will be included in the over-excavation of the adit A-1 (Figure 3) opening. A separate closure is not proposed for VO-1.

Construction of the closures will require over-excavation using a mini-excavator to expose surrounding competent material. The opening will then be prepared for the 24 in. CMP culvert where a maximum of 6 in. of head room found between the top of the culvert and the top of the adit ceiling. This area will be filled with a non-shrink grout, and to the outside, a grouted rock bulkhead will be constructed around the perimeter of the culvert, conforming to the excavated adit opening. The culvert will be installed into the adit opening as far as possible while maintaining minimum protrusion from the entrance. Trihydro proposes a 10 ft section of CMP culvert be installed in each of the closures. A rectangle bat gate, constructed with 3/8 in. by 4 in. steel plate will be installed into the mouth of the culvert through slots cut in the CMP. A construction detail for the bat-compatible closures can be found on Figure 8.

Trihydro developed a cost estimate for the culvert with a bat gate culvert closure materials, equipment, and labor, and it is included as Appendix D-3. The estimated cost for the adits A-1, A-2, and A-3 closure is approximately $22,570. The cost estimate also includes a line item for site access improvements. Trihydro anticipates the work for the adit closures will require three days with an experienced contractor. The cost estimate does not provide costs for oversight.

6.0 SUMMARY

The County Road A-25 (A-25) subsidence features were first discovered by Colfax County Road Department during routine maintenance in late 2021. AML was notified of the active subsidence features in and adjacent to Colfax County Road by the Colfax County Road Department shortly after discovering the features. There are four active subsidence features lining a sandstone crack that crosses the A-25 road alignment. Investigations of the subsidence features were completed by Trihydro and their Subcontractor, Ground Penetrating Radar System, LLC, (GPRS) on October 22, 2021; December 1-3, 2021, and May 26, 2022.

GPRS conducted a 350/400MHz antenna on December 2nd, 2021. Detected void boundaries were marked with blue paint. GPRS was unable to determine the depth to the bottom of the voids or volume of a voids. Only the largest voids were detected. On December 3rd, 2021, GPRS conducted the 200MHz scan of the subsidence area. The 200MHz scan was inconclusive due to the small size of the voids.

GPRS conducted the initial EMI survey on December 3, 2021, but later found that the data was unusable. GPRS then conducted another EMI survey at the site on May 26, 2022. The EMI report notes several strong reaction areas throughout the A-25 alignment, particularly along the western edge of the scan boundary. GPRS notes that the strong reaction areas may indicate areas of potential voids or other subsurface objects.

Through the review of historic mining documents and the surface and subsurface investigations of the A-25 subsidence and adjacent areas, Trihydro believes that the A-25 subsidence features are linked to the historic underground mining of the area. While there is nothing definitive in the historic documents to tie the subsidence features to historic underground mining in the area, the overall signs, when taken together, show a strong link between the features and historic mining. Trihydro believes that mine workings are about 5.5 ft thick and may be fairly shallow (15 – 25 ft) near the A-25 subsidence due to the location of the Turner Mine adit and the 2-degree coal seam dip (Nickelson, n.d.; NMBGMR, n.d.b.).

Trihydro believes that the sandstone cap rock immediately adjacent to the subsidence features is fairly competent. The sandstone shows little weathering. While Trihydro believes the risk of failure of the road remains minimal, the subsidence features in the sandstone crack will eventually become large enough that a standard passenger vehicle may not be able to traverse the area.

Trihydro recommends that action be taken to limit the continued subsidence of the A-25 features as well as closure of the Denton and Turner-Urtado adits. Trihydro presented reclamation recommendations and construction details for the

A-25 subsidence area and adits. Trihydro's preferred reclamation alternative to stabilize County Road A-25 is to drill and grout any voids discovered in the subsidence investigation area that are deemed unstable by the experienced geologist or engineer. Colfax County should continue to monitor the area for deflection and subsidence monthly no matter which methods are ultimately chosen.

7.0 REFERENCES

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Lee, W. T. 1924. Coal Resources of the Raton Coal Field, Colfax County, New Mexico. U.S. Geological Survey, Bulletin.

New Mexico Bureau of Geology and Mineral Resources. n.d.a., Map No. 5394. Yankee Quadrangle. U.S. Department of the Interior Geological Survey.

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New Mexico Bureau of Geology and Mineral Resources. 1978. Resource Map No. 10, Coal Fields and Mines of New Mexico.

Nickelson, H. B., n.d. Memorandums to Steve Frost regarding coal mines in the Raton, New Mexico area. NewMexico Bureau of Mines and Mineral Resources.

Pillmore, C. L. 1976. Commercial Coal Beds of the Raton Coal Field, Colfax County, New Mexico. In: Vermejo Park, Ewing, R. C.; Kues, B. S. (eds.), New Mexico Geological Society 27th Annual Fall Field Conference Guidebook.

FIGURES

Image Cite: ESRI World Street Map, Publication: 2022

1 **NEW MEXICO STATE MAP**
SCALE: 1" = 70 MILES
0 70 MILES

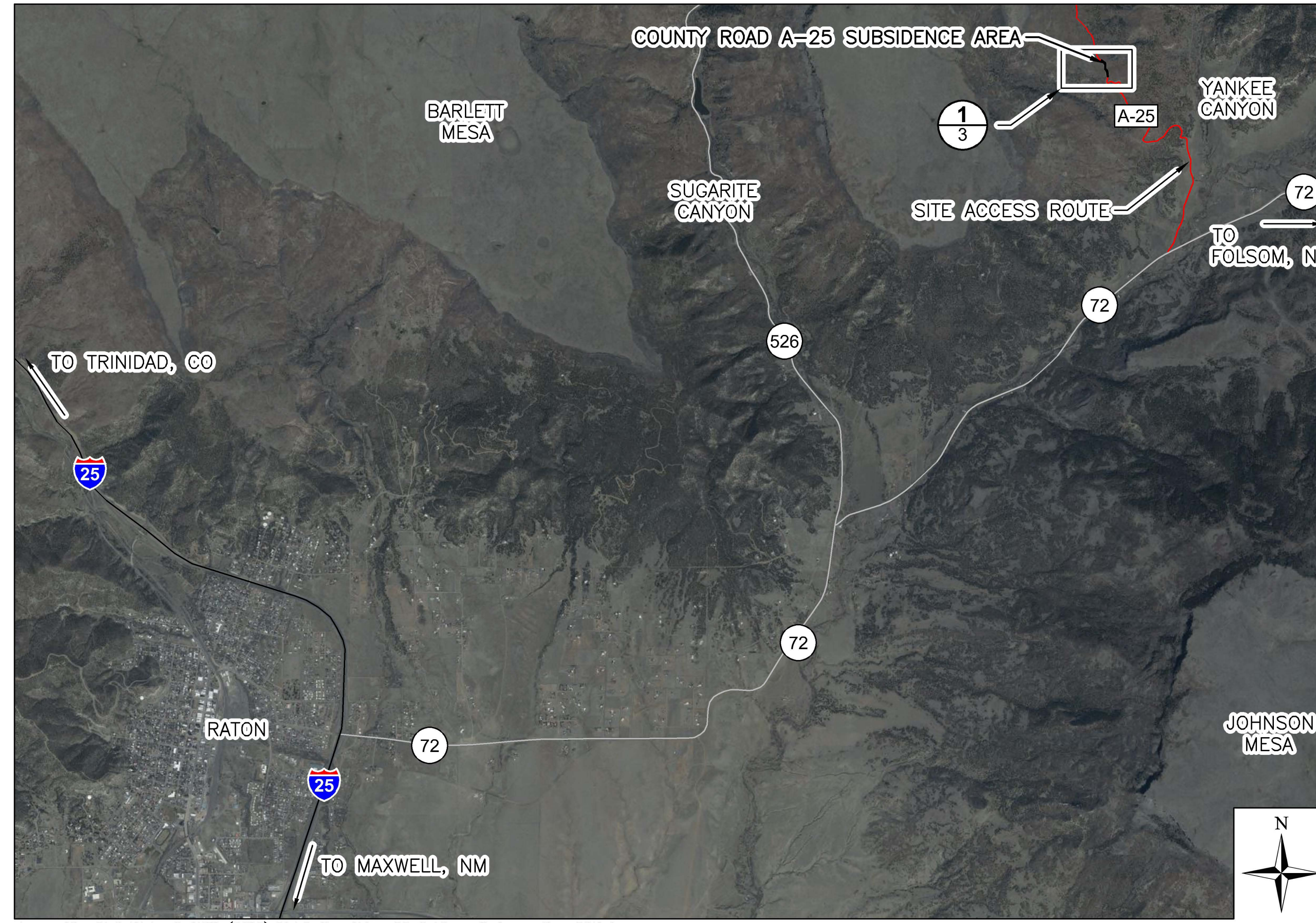

Image Cite: DigitalGlobe © CNES (2022) Distribution Airbus DS © Microsoft Corporation, BING Imagery

2 **SITE LOCATION AND ACCESS MAP**
SCALE: 1" = 5000'
0 5,000'

EXPLANATION

25 INTERSTATE HIGHWAY	A-25 COUNTY ROAD
72 STATE HIGHWAY	★ PROJECT LOCATION

NOTE:

THE COUNTY ROAD A-25 SUBSIDENCE AREA CAN BE ACCESSED BY TRAVELING EAST FROM THE HWY 72/I-25 INTERCHANGE FOR 3.68 MILES UNTIL THE JUNCTION OF HWY 526 AND HWY 72. TURN RIGHT TO STAY ON HWY 72, AND TRAVEL 2.82 MILES ON HWY 72 TO COUNTY ROAD A-27. TURN SLIGHT LEFT ONTO COUNTY ROAD A-27, AND TRAVEL 1.61 MILES ON COUNTY ROAD A-27 TO A JUNCTION WITH COUNTY ROAD A-25. TURN SLIGHT LEFT ONTO COUNTY ROAD A-25, AND TRAVEL 1.05 MILES, UP THE SWITCH BACKS, ALONG COUNTY ROAD A-25 TO A SWITCH BACK BELOW THE A-25 SUBSIDENCE FEATURES. PARKING IS AVAILABLE AT THE SWITCH BACK BELOW THE SUBSIDENCE FEATURE AREA.

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FIGURE 1

SITE LOCATION AND ACCESS MAP

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: JD	Checked By: TH	Scale: AS SHOWN	Date: 5/13/22	File: 01A-YANKEE_SITEVICINITY

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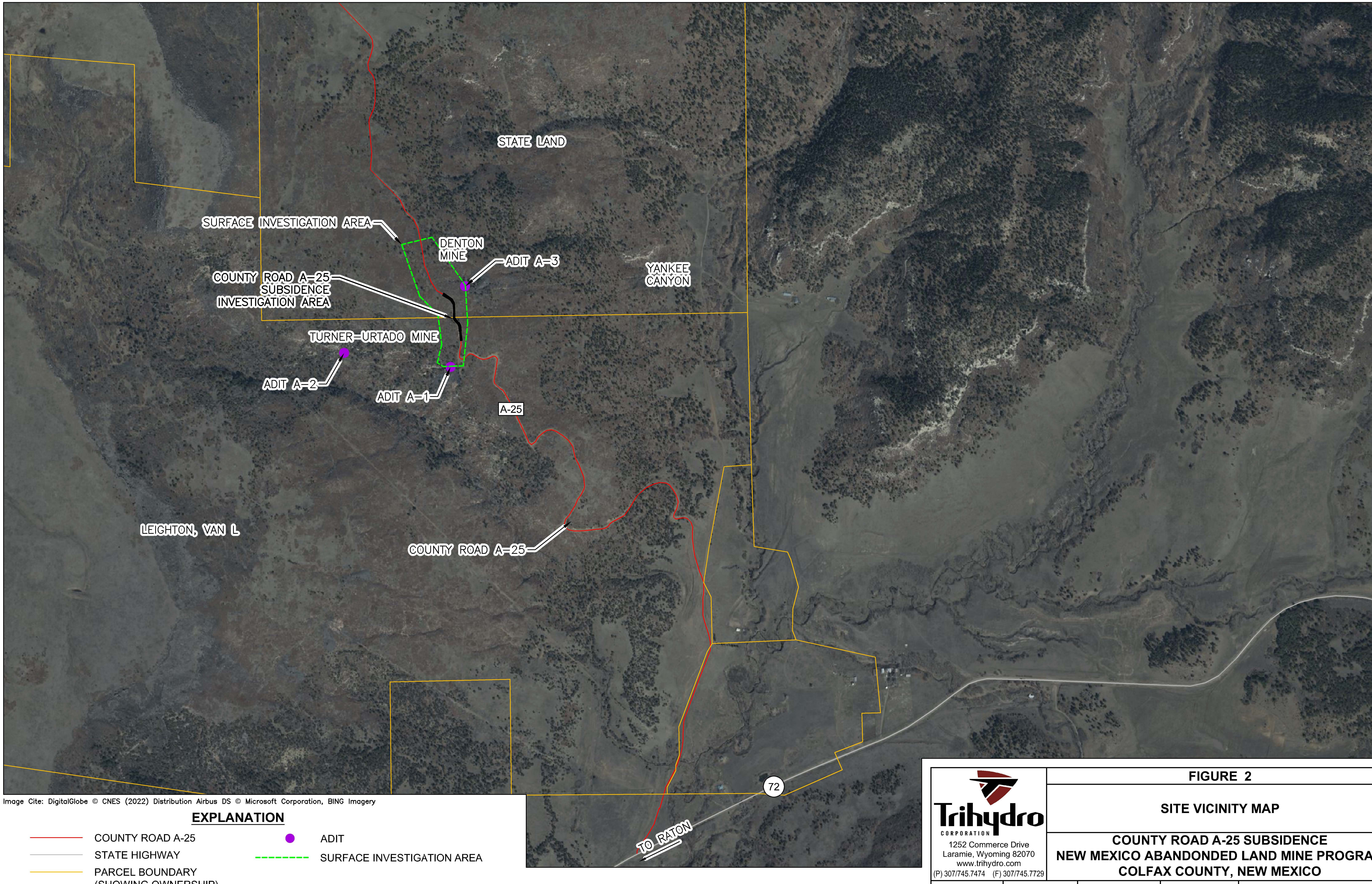

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FIGURE 2

SITE VICINITY MAP

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: JD	Checked By: TH	Scale: AS SHOWN	Date: 5/13/22	File: 01A-YANKEE_SITEVICINITY

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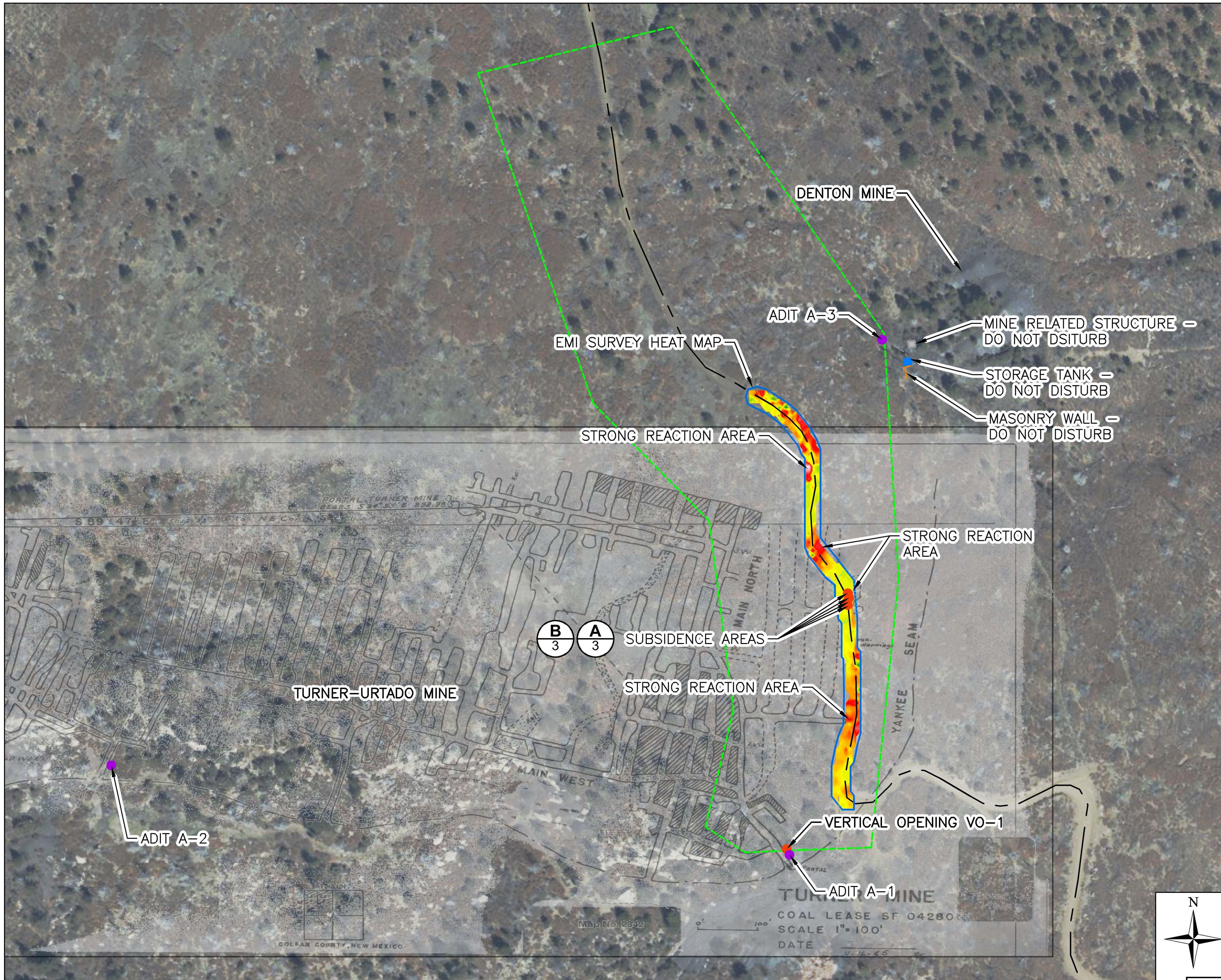

Image Cite: DigitalGlobe © CNES (2022) Distribution Airbus DS © Microsoft Corporation, BING Imagery

(A) **COUNTY ROAD A-25 SUBSIDENCE FEATURE**
SCALE: NONE

(B) **COUNTY ROAD A-25 SUBSIDENCE FEATURES**
SCALE: NONE

NOTE:

1. DARKER RED AND WHITE COLORED AREAS IN THE ELECTROMAGNETIC INDUCTION (EMI) SURVEY HEAT MAP INDICATE AREAS OF STRONGER REACTIONS, AND MAY COINCIDE WITH SUBSURFACE VOIDS.

(1) **EXISTING SITE AREA - PLAN VIEW**
SCALE: 1" = 150'

0 200'

EXPLANATION

(dashed black line)	EXISTING A-25 ROAD
(orange line)	EXISTING MASONRY WALL
(grey fill)	EXISTING STRUCTURE
(dotted cyan line)	GPR STUDY AREA
(dashed green line)	SURFACE INVESTIGATION AREA
(blue line)	EMI SURVEY BOUNDARY
(dashed grey line)	EXISTING UNPAVED ROAD
(purple dot)	ADIT
(red dot)	SUBSIDENCE FEATURES
(blue dot)	EXISTING TANK

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FIGURE 3

EXISTING SITE AREA MAP

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: JD	Checked By: TH	Scale: 1" = 150'	Date: 5/13/22	File: 01A-YANKEE_EXISTINGSITE

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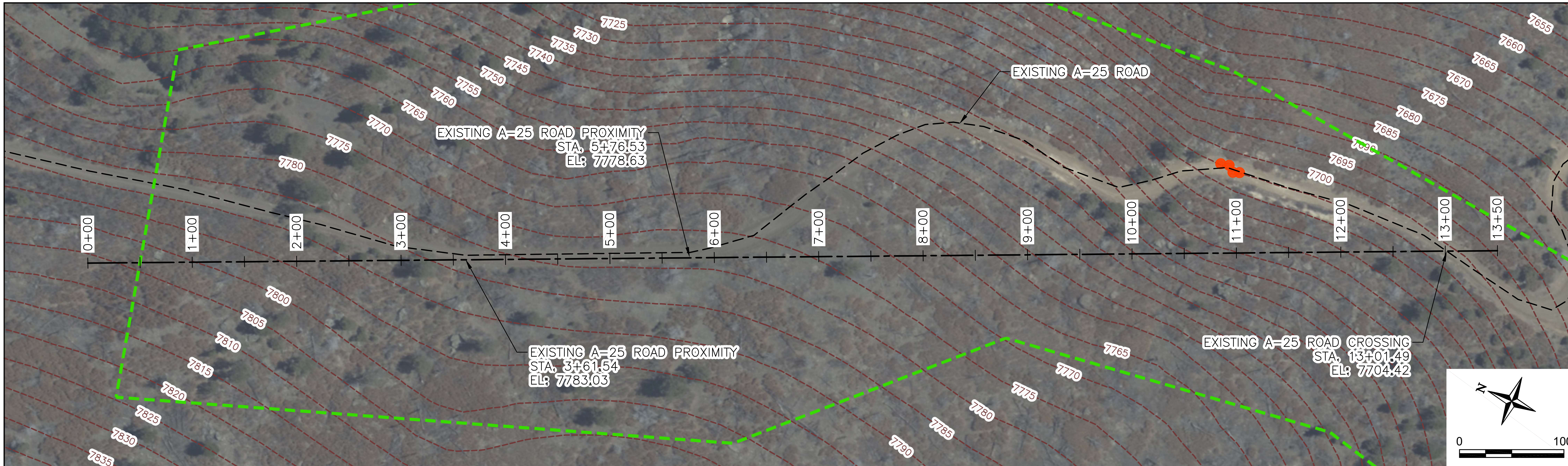
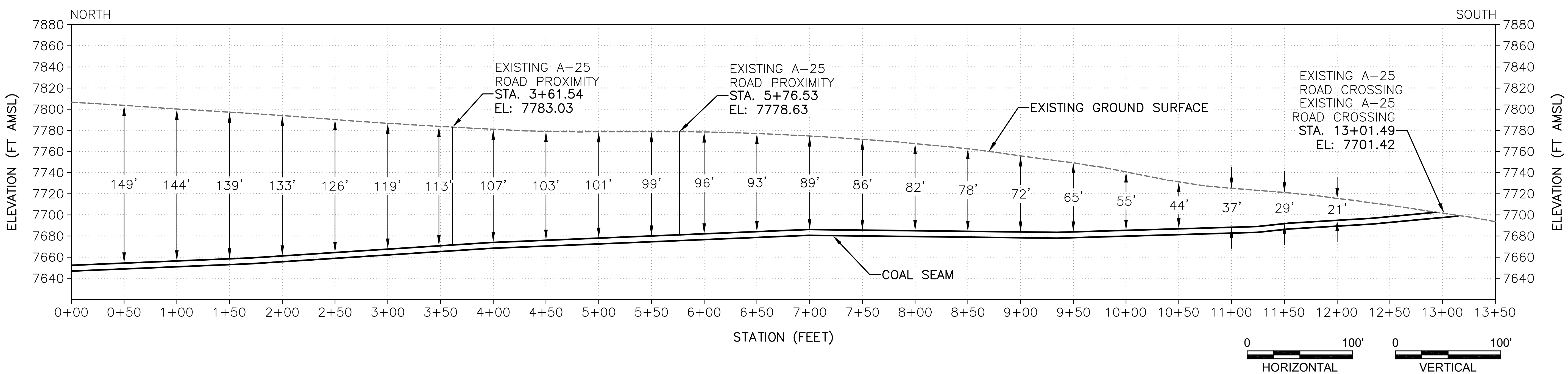


Image Cite: DigitalGlobe © CNES (2022) Distribution Airbus DS © Microsoft Corporation, BING Imagery



EXPLANATION

— — — — — —	EXISTING A-25 ROAD
- - - - - - (green)	SURFACE INVESTIGATION AREA
----- 7835 -----	EXISTING SURFACE CONTOUR, 5 FOOT INTERVAL
●	SUBSIDENCE FEATURES
FT AMSL	FEET ABOVE MEAN SEA LEVEL

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FIGURE 4

PROJECTED DEPTH TO COAL SEAM CROSS-SECTION

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: REP	Checked By: MR	Scale: AS SHOWN	Date: 12/15/22	File: 01A-YANKEE_XSEC-202212

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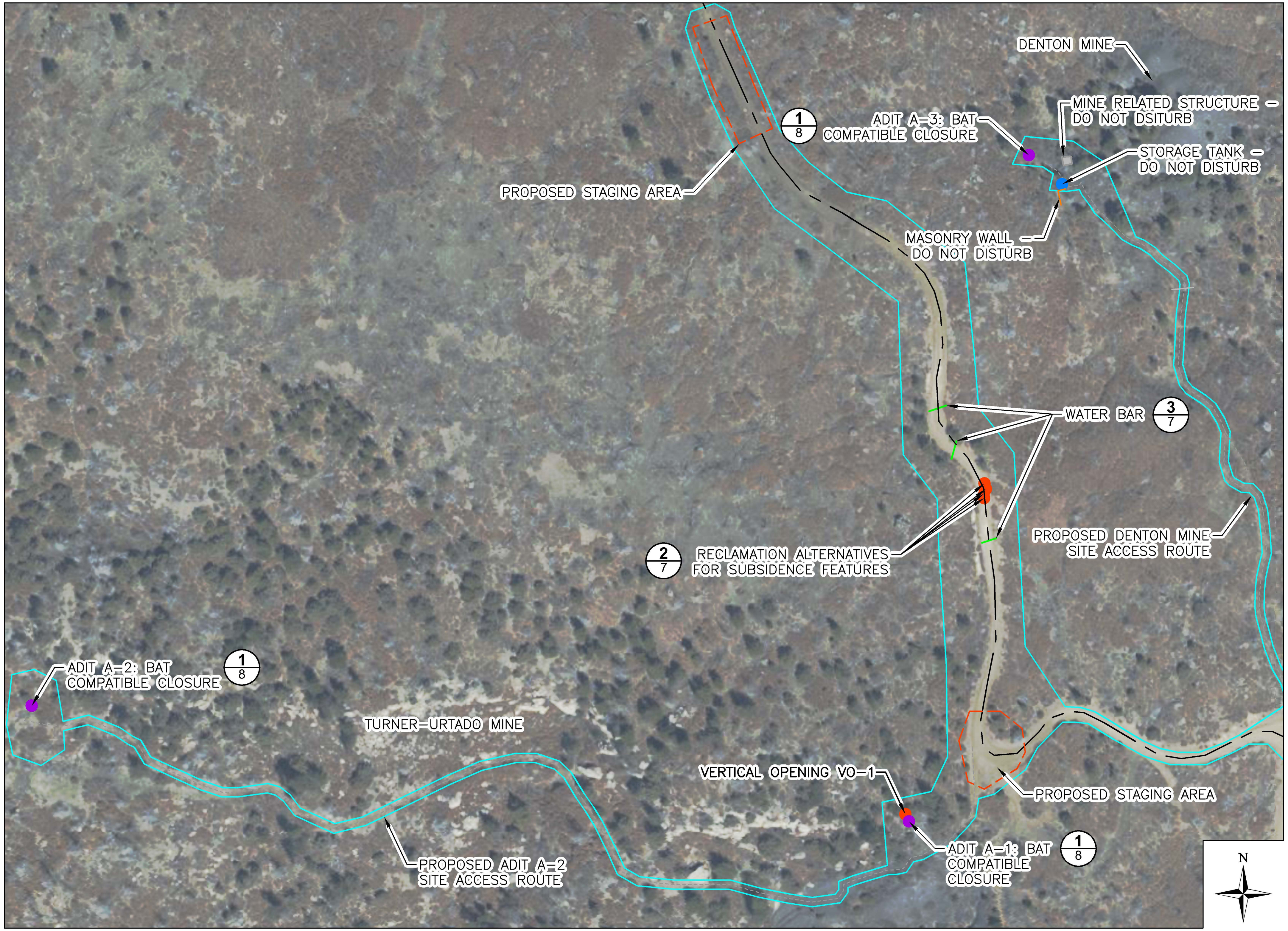
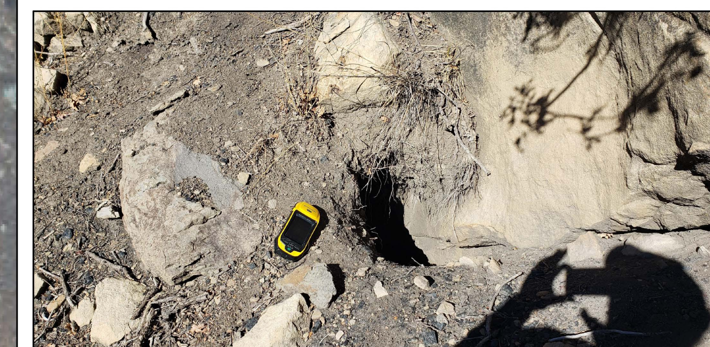


Image Cite: DigitalGlobe © CNES (2022) Distribution Airbus DS © Microsoft Corporation, BING Imagery

A ADIT A-1
SCALE: NONE



B ADIT A-2
SCALE: NONE

C ADIT A-3
SCALE: NONE

1 PROPOSED SITE AREA - PLAN VIEW
SCALE: 1" = 150'

0 150'

EXPLANATION

EXISTING A-25 ROAD	SUBSIDENCE INVESTIGATION AREA
EXISTING MASONRY WALL	EXISTING UNPAVED ROAD
AREA OF PROBABLE EFFECT (APE) BOUNDARY	STAGING AREA
EXISTING STRUCTURE	WATER BAR

- ADIT
- SUBSIDENCE FEATURES
- EXISTING TANK

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FIGURE 5

PROPOSED SITE AREA MAP

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: JD	Checked By: TH	Scale: 1" = 150'	Date: 12/30/22	File: 01A-YANKEE_PROPOSEDSITE

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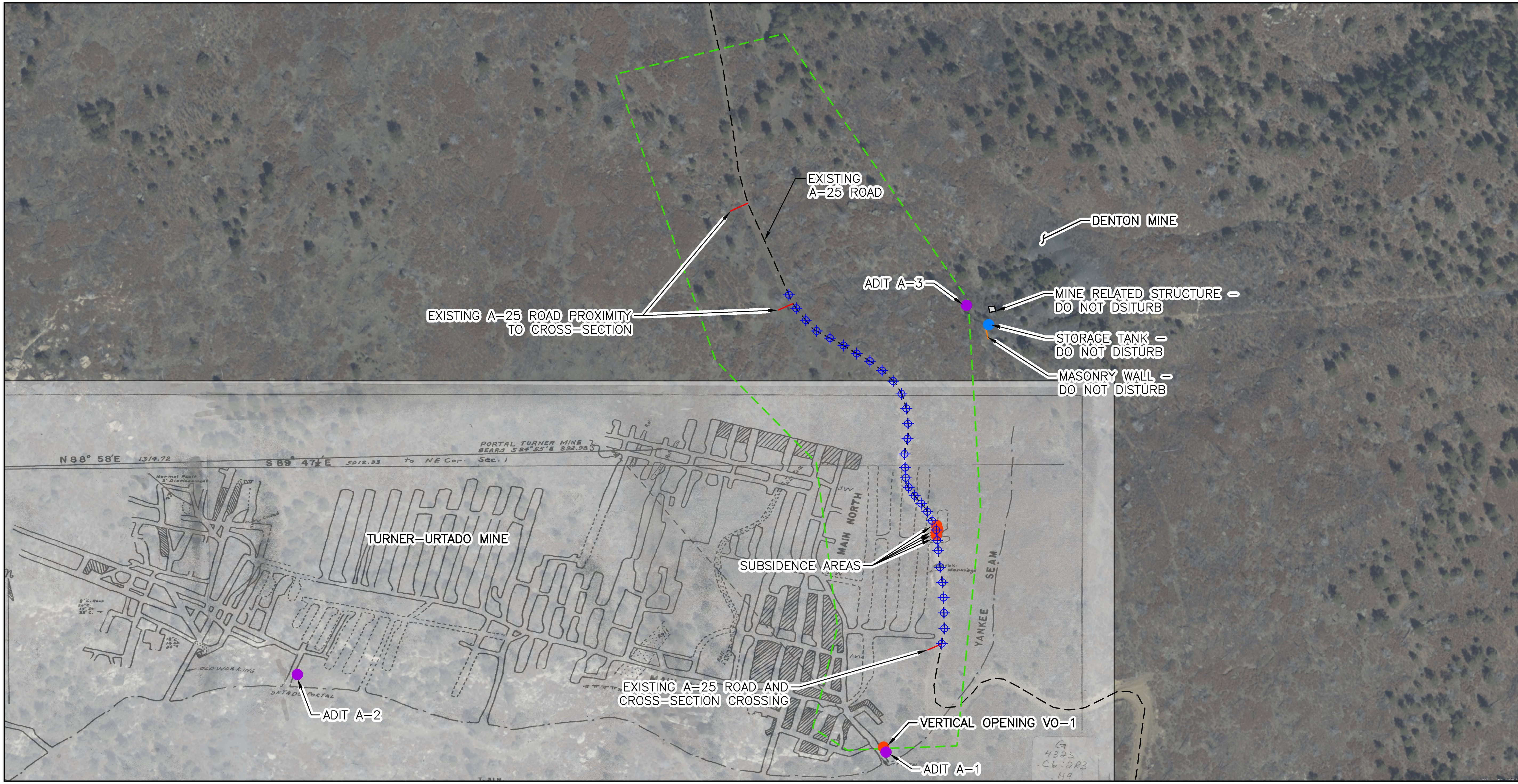

Image Cite: DigitalGlobe © CNES (2022) Distribution Airbus DS © Microsoft Corporation, BING Imagery

EXPLANATION

⌖	PROPOSED DRILL HOLE LOCATION
— — —	EXISTING A-25 ROAD
- - - (green)	SURFACE INVESTIGATION AREA
▭	BUILDING OR OTHER STRUCTURE
● (purple)	ADIT
● (red)	SUBSIDENCE FEATURES
● (blue)	EXISTING TANK

N

0 200'

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FIGURE 6

PROPOSED DRILL HOLE LOCATIONS

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: REP | Checked By: MR | Scale: 1" = 200' | Date: 12/15/22 | File: 01A-YANKEE_PROPLOCS-202212

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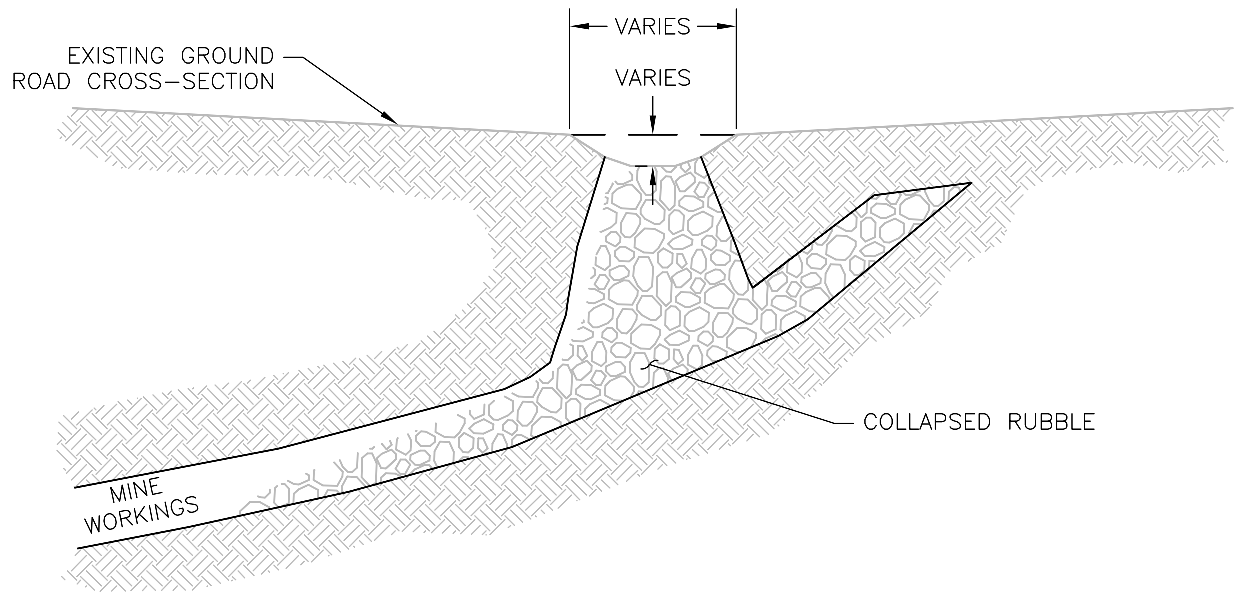
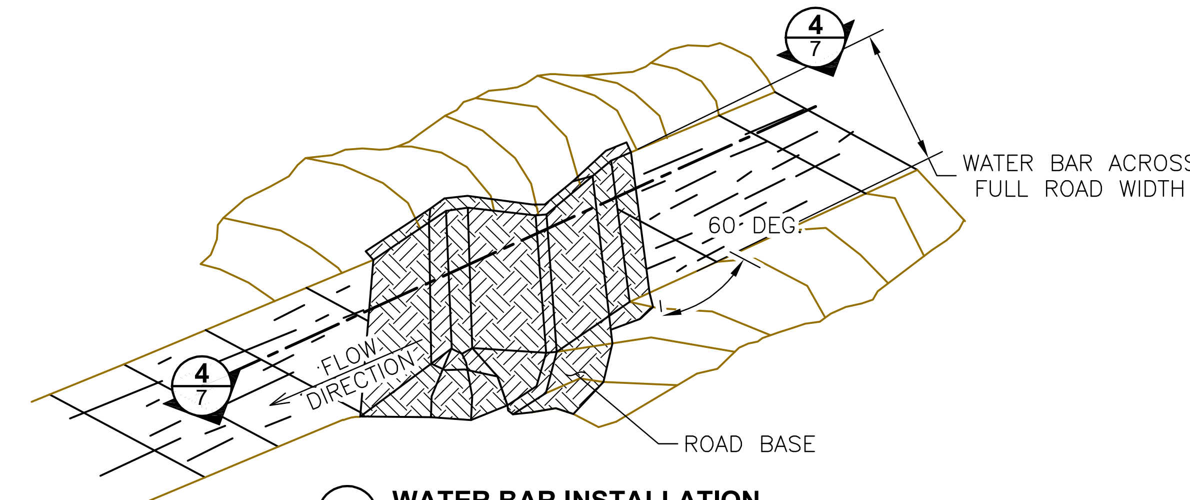
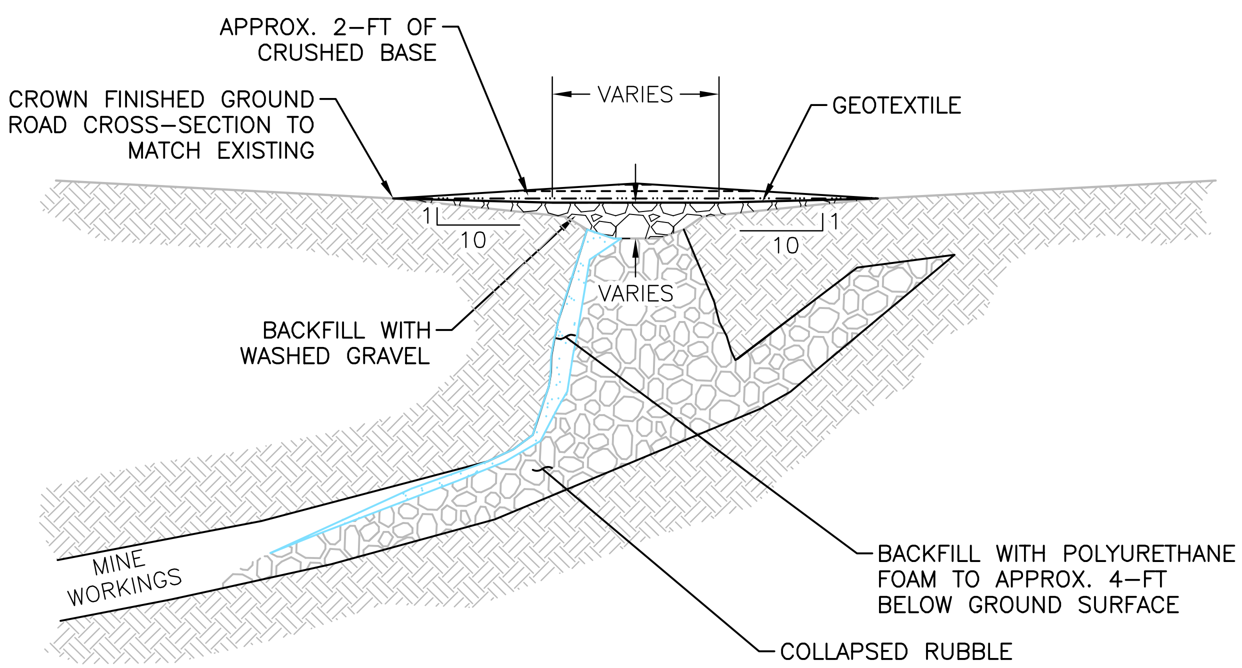


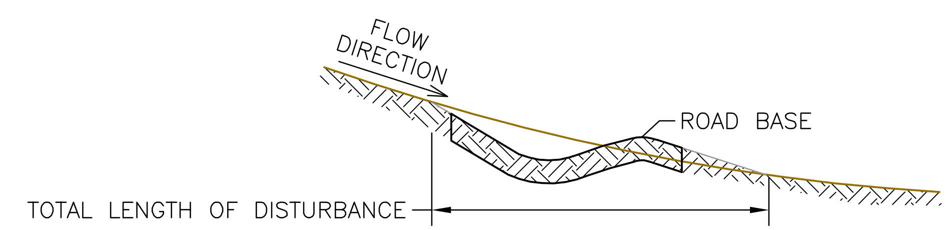
1 **EXISTING ROAD SUBSIDENCE - CROSS-SECTION VIEW**
SCALE: NONE



3 **WATER BAR INSTALLATION**
SCALE: NONE



2 **POLYURETHANE FOAM BACKFILL CLOSURE - CROSS-SECTION VIEW**
SCALE: NONE



4 **WATER BAR PROFILE**
SCALE: NONE

NOTES:

1. THE SUBSIDENCE CLOSURE DETAIL REPRESENTS A TYPICAL CROSS-SECTION OF WHAT SUBSURFACE CONDITIONS MAY BE PRESENT AT THE COUNTY ROAD A-25 SITE. SUBSURFACE CONDITIONS ARE STILL LARGELY UNKNOWN AS OF ISSUANCE OF THIS REPORT.
2. THE POLYURETHANE FOAM CLOSURE IS RECOMMENDED FOR USE IN SHALLOW SUBSIDENCE FEATURES WITH MINIMAL CONNECTIVITY BETWEEN THE SUBSIDENCE AND UNDERGROUND MINE WORKINGS.

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FIGURE 7

COUNTY ROAD A-25 SUBSIDENCE CLOSURE DETAILS

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: JD	Checked By: TH	Scale: NONE	Date: 7/11/22	File: 01A-YANKEE_DETAILS_MR

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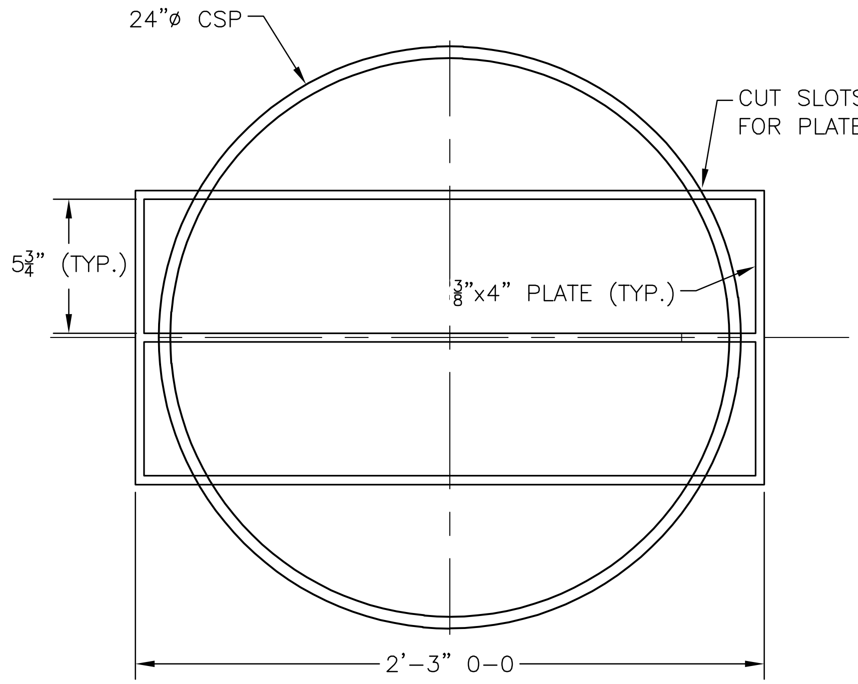
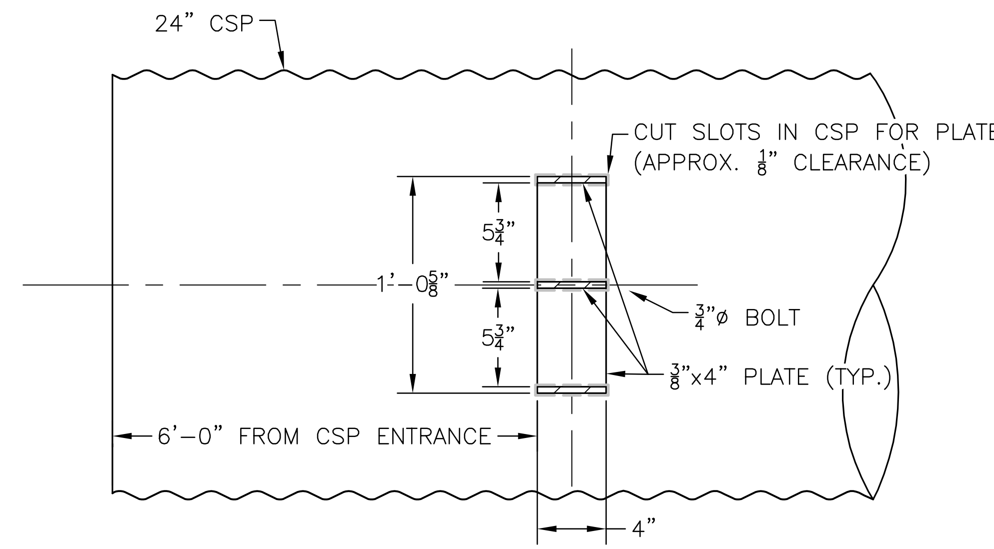


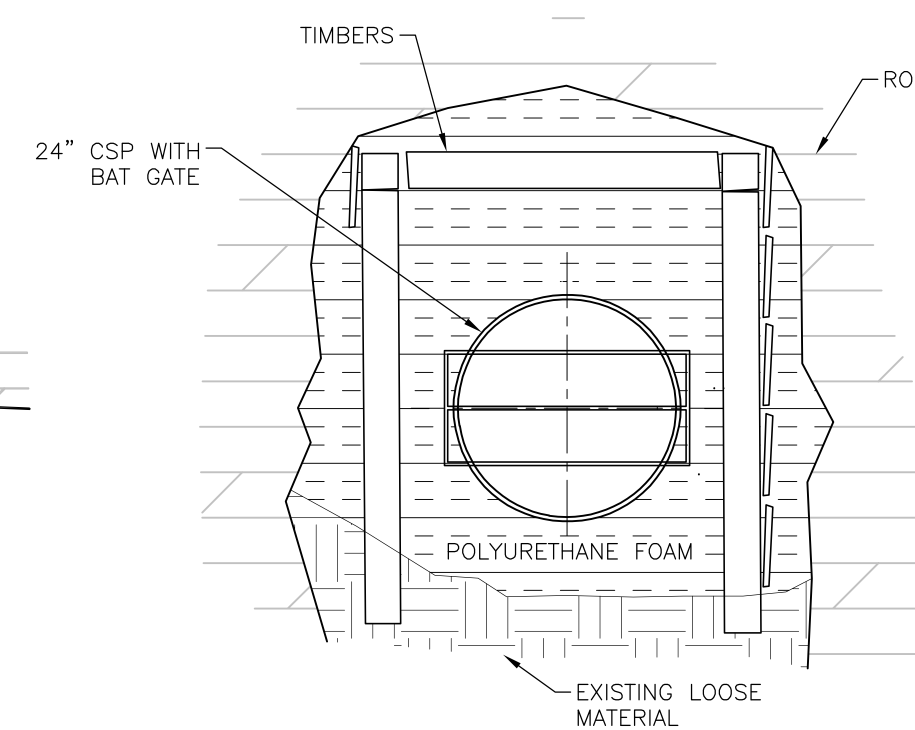
A **BAT GATE - ELEVATION VIEW**
SCALE: NONE



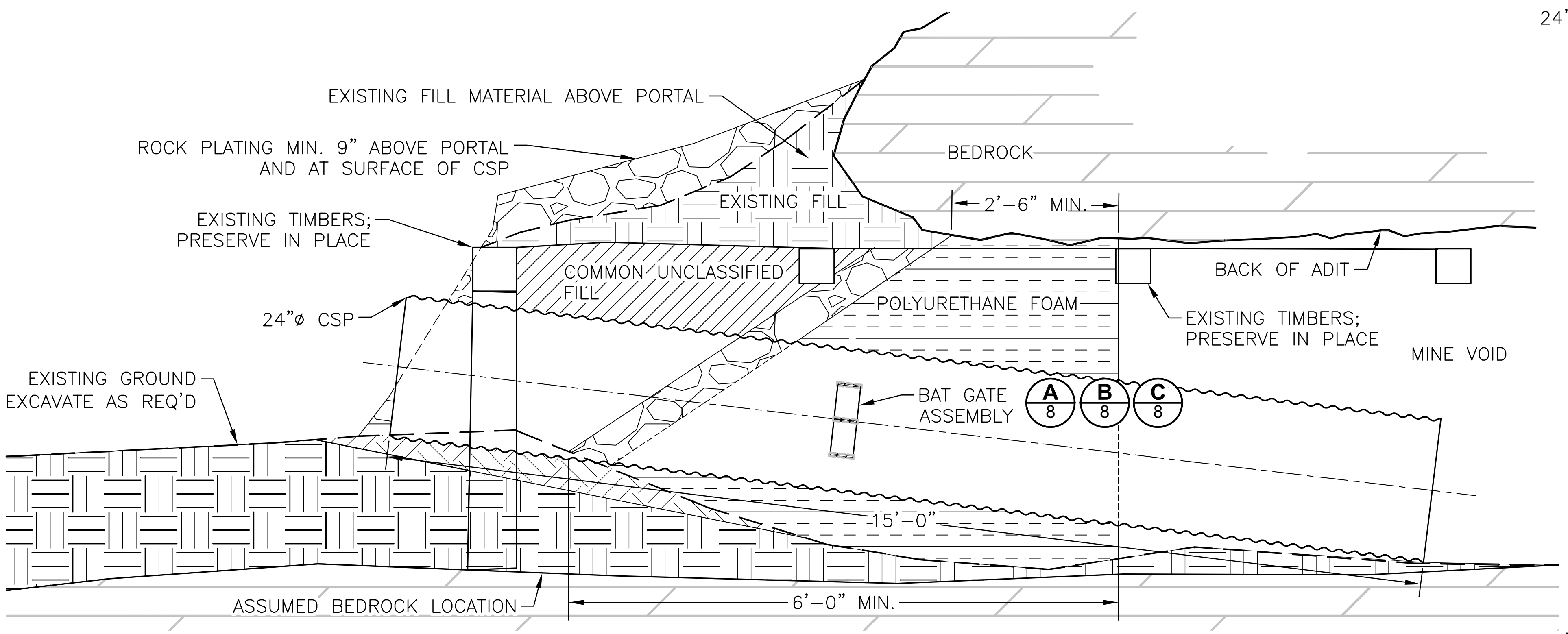
B **BAT GATE - SECTION VIEW**
SCALE: NONE

NOTES:

1. THE SHAPE AND DIMENSIONS SHOWN FOR THE EXISTING ADIT OPENINGS ARE APPROXIMATE. FIELD VERIFY ALL DIMENSIONS BEFORE FABRICATION.
2. STEEL PLATES SHALL BE WEATHERING STEEL. WELD ALL JOINTS. CONSTRUCT THE BAT GATE TO ELIMINATE SURFACES ON WHICH MOISTURE OR DEBRIS CAN BE TRAPPED.
3. THE CONTRACTOR HAS THE OPTION OF USING 8" STEEL PLATE WHERE 4" STEEL PLATE IS SHOWN IN THE DRAWING.
4. VERIFY THAT THE OPENINGS OF THE CSP ARE NOT OBSTRUCTED BY FILL OR ROCK.
5. POLYURETHANE CAN BE PLACED VERTICALLY INSTEAD OF SLOPED AS SHOWN IN THE DRAWING. IF PLACED VERTICALLY, USE 4'-0" AS AVERAGE THICKNESS OF PLUG.
6. PLACE ROCKS 6" INTO ENTIRE OUTER SURFACE OF POLYURETHANE FOAM BEFORE IT CURES.
7. THE FINISHED GRADE ON THE OUTSIDE OF THE CULVERT SHALL HAVE POSITIVE DRAINAGE AWAY FROM THE STRUCTURE.



C **BAT GATE - FRONT SECTION VIEW**
SCALE: NONE



1 **CULVERT AND BAT GATE CLOSURE DETAIL - SECTION VIEW**
SCALE: NONE

CAUTION - THIS PROJECT REQUIRES CONSTRUCTION WORK IN, AROUND, AND OVER HAZARDOUS AND UNPROTECTED MINE SHAFTS, STOPES, ADITS, AND OTHER OPENINGS WHICH MAY BE OPEN TO THE SURFACE OR HIDDEN FROM VIEW BY TRASH, DEBRIS, OR THIN AND UNSTABLE LAYERS OF SURFACE MATERIALS OR ROCK. THE CONSTRUCTOR SHALL BE RESPONSIBLE FOR THOROUGHLY INVESTIGATING THE SITE CONDITIONS AND SCHEDULING EQUIPMENT, EQUIPMENT OPERATIONS, PERSONNEL AND SAFETY PROCEDURES TO PREVENT ACCIDENTS AND INJURIES.

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FIGURE 8

CULVERT WITH BAT GATE CLOSURE DETAIL

COUNTY ROAD A-25 SUBSIDENCE
NEW MEXICO ABANDONDED LAND MINE PROGRAM
COLFAX COUNTY, NEW MEXICO

Drawn By: MR	Checked By: TH	Scale: NONE	Date: 12/27/22	File: 01A-YANKEE_DETAILS_MR

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APPENDIX A

GPR/EMI REPORTS

Summary of Scanning for Subsurface Voids

Prepared For: Trihydro

Prepared By:
Hunter Polley
Hunter.polley@gprsinc.com
Project Manager -Central Region (Denver)
303.941.5195

December 7, 2021

GPRS SUBSURFACE SCANNING SOLUTIONS

December 7, 2021

Trihydro
Attn: Tyrel Hurlet
Site: Raton, New Mexico

We appreciate the opportunity to provide this report for our work completed on December 2, 2021.

PURPOSE

The purpose of the project was to search for subsurface voids that may be present within the scanned areas and, if found, to mark out their approximate boundaries. The scope of work consisted of a location measuring approximately 2000 sq ft. The client marked the desired locations prior to our scanning and our markings were then placed onto the ground using spray paint.

EQUIPMENT

- **Underground Scanning GPR Antenna**. The antenna with frequencies ranging from 250 MHz-450 MHz is mounted in a stroller frame which rolls over the surface. The surface needs to be reasonably smooth and unobstructed in order to obtain readable scans. Obstructions such as curbs, landscaping, and vegetation will limit the feasibility of GPR. The data is displayed on a screen and marked in the field in real time. GPR works by sending pulses of energy into a material and recording the strength and the time required for the return of the reflected signal. Reflections are produced when the energy pulses enter into a material with different electrical properties from the material it left. The strength of the reflection is determined by the contrast in signal speed between the two materials. The total depth achieved can be as much as 8' or more with this antenna but can vary widely depending on the conductivity of the materials. Conductive soil types such as clay may limit maximum depths to 3' or less. As depth increases, targets must be larger in order to be detected and nonmetallic targets can be especially difficult to locate. Depths provided should always be treated as estimates as their accuracy can be affected by multiple factors. For more information, please visit: Link
- **GPS**. This handheld GPS unit offers accuracy down to 4 inches. However, the accuracy will depend on the satellite environment and obstructions and should not be considered to be survey-grade. Features can be collected as points, lines, or areas and then exported into Google Earth or overlaid on a CAD drawing. For more information, please visit: Link
- **Frequency Domain Electromagnetic Induction (EMI)**. EMI instruments contain two sets of coils that are located on opposite ends of the tool. One set of coils is used to transmit a primary magnetic field, which generates an electrical current into the ground. The induced current then generates a secondary magnetic field, which is sensed by the coils in the receiver end of the instrument. The EMI is moved over the surface without coming in contact with the surface so it is not affected by the terrain. However, EMI results are affected by surface features including vehicles, reinforced concrete, and buildings and will not be used in the vicinity of above-ground obstructions. Data is then displayed on a control unit indicating the conductivity of the earth or buried objects. The data is post-processed and displayed in a color-coded contour map which shows relative changes in conductivity. This contour map will be provided by GPRS for interpretation by the client. For more information, please visit: Link
- **200 MHz GPR Antenna**. The antenna is pulled by a handle directly across the surface. The surface needs to be reasonably smooth and unobstructed in order to obtain readable scans. Obstructions such as curbs, landscaping, and vegetation will limit the feasibility of GPR. The data is displayed on a screen and marked in the field in real time. GPR works by sending pulses of energy into a material and recording the strength and the time required for the return of the reflected signal. Reflections are produced when the energy pulses enter into a material with different electrical properties from the material it left. The strength of the reflection is determined by the contrast in signal speed between the two materials. The total depth achieved can be as much as 20' or more with this antenna but can vary widely depending on the conductivity of the materials. Conductive soil types such as clay may limit maximum depths to 3' or less. As depth increases, targets must be larger in order to be detected and nonmetallic targets can be especially difficult to locate. Depths provided should always be treated as estimates as their accuracy can be affected by multiple factors. For more information, please visit: Link

PROCESS

The process begins by using GPR to collect initial scans throughout the area. These scans are used to calibrate the equipment and determine the data quality, maximum depth penetration, and any other potential limitations. Each location is then scanned with a scan spacing of approximately 3'. The GPR data is viewed in real time and anomalies in the data were located and marked on the surface. Relevant scan examples were saved and will be provided in this report.

LIMITATIONS

Please keep in mind that there are limitations to any subsurface investigation. The equipment may not achieve maximum effectiveness due to soil conditions, above ground obstructions, reinforced concrete, and a variety of other factors. No subsurface investigation or equipment can provide a complete image of what lies below. Our results should always be used in conjunction with as many methods as possible including consulting existing plans and drawings, exploratory excavation or potholing, visual inspection of above-ground features, and utilization of services such as One Call/811.

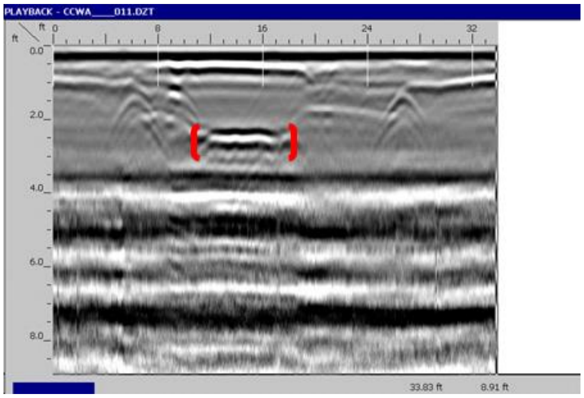
Void mapping is not a definitive process. A void will be the highest amplitude negative response in the GPR signal but there are materials other than air that may cause strong negative responses. Therefore, there may be false positives in our findings. There also may be voids that are not able to be detected for a number of reasons. GPR can determine the approximate boundaries/edges of voids that are detected along with the approximate depth to the top of the void but cannot determine the depth to the bottom of the void (volume).

FINDINGS

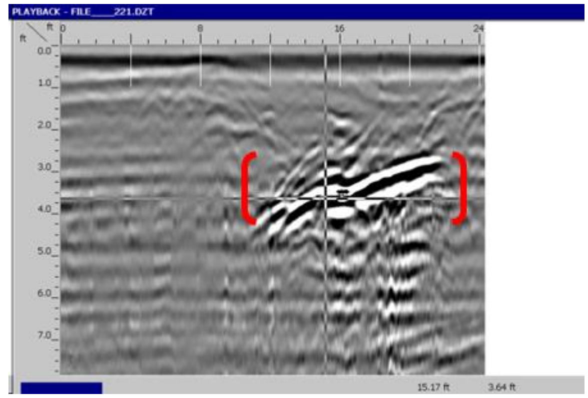
Based on the areas scanned, potential voids were found within the areas shown in the supporting photos, data, and site map provided. The following pages outline data from scans performed during this investigation. The following pages will provide further explanation of the findings.

The following pages will provide photos and further explanation of our findings.

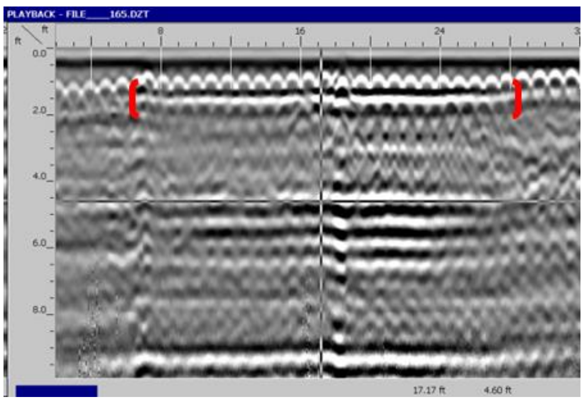
Prepared for: Trihydro Prepared By: Hunter Polley Date of Scanning: Dec 2, 2021	**Terms and Conditions** GPRS does not provide land survey or civil engineering data collection or documentation. This is provided as a reference map of the field markings and is not survey-grade.	**LEGEND** ELECTRIC WATER COMM GAS SANITARY STORM UNKNOWN	Raton, New Mexico	Prepared by: GPRS



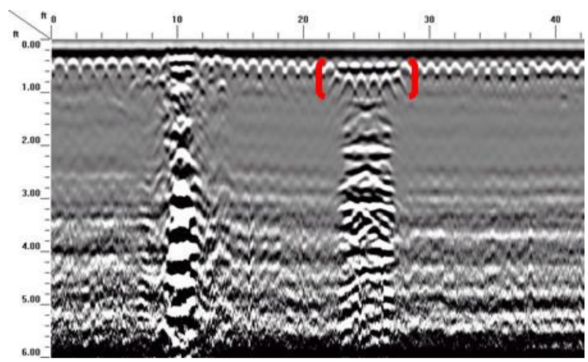
Sample GPR data screenshot showing a void that was confirmed to exist. It was located in a trench for a water line and was below the slurry topping layer. The GPR reflection off of the air at the top of the void will typically appear as a black band in the data as shown above.



Sample GPR data screenshot showing a potential void. Changes in soil or backfill that have much different electrical properties than the soil that is being traveled through can cause high contrast reflections that appear to be voids but may not be and would require destructive testing to verify.



Sample GPR data screenshot showing a void that was verified to exist directly below a concrete slab that was reinforced with rebar.



Sample GPR data screenshot showing a void that was verified to exist directly below a concrete slab that was reinforced with rebar but is actually the top of a manmade structure such as a basement or tunnel.

Sample Data Screenshots. (Not taken from this project)	Location: previously collected from various sites	GPRS

Site photo of the crack in the rocky area being scanned.

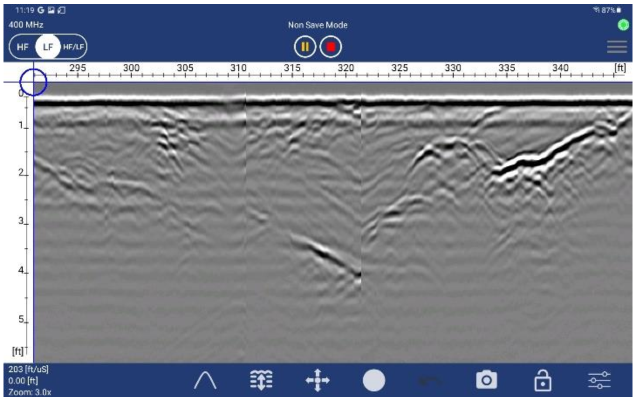
Site photo of the scan area above the rocky area with the crack.

Photo of the road with the area of concern.

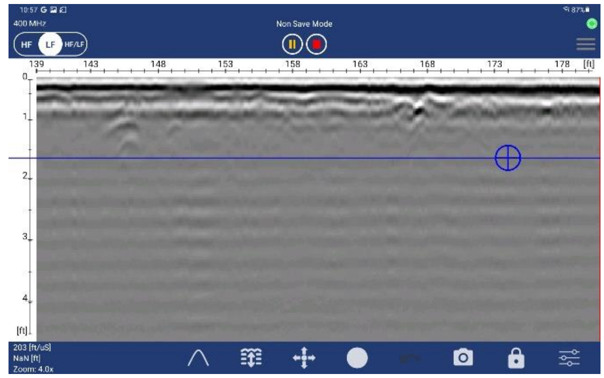
Photo of the road just above the crack, in the scan area.

Closer photo of the crack and area of concern, in this photo you can see the blue lines indicating a similar reaction of right over the crack, possibly where the crack is continuing.

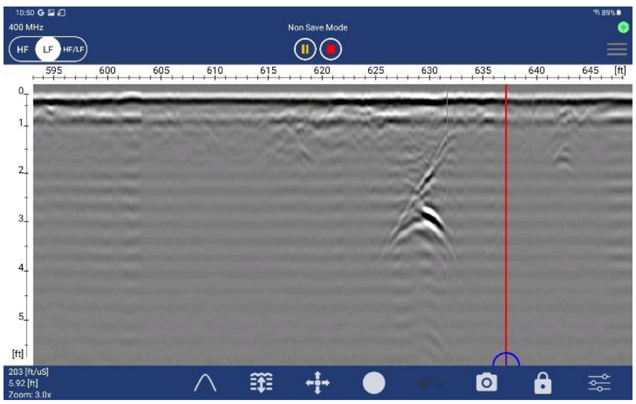
Site photo above the crack looking down the road to the other end of the scan area.



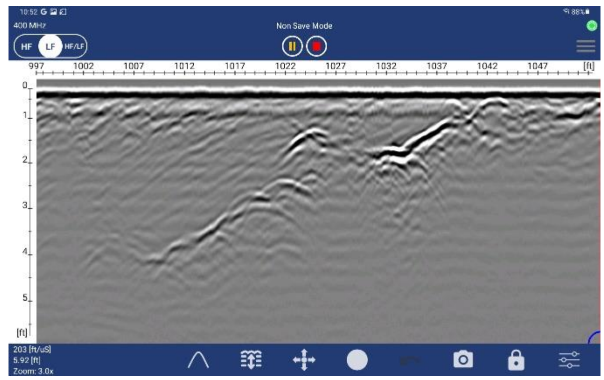
Data screenshot of the rocky area being scanned directly over the crack.



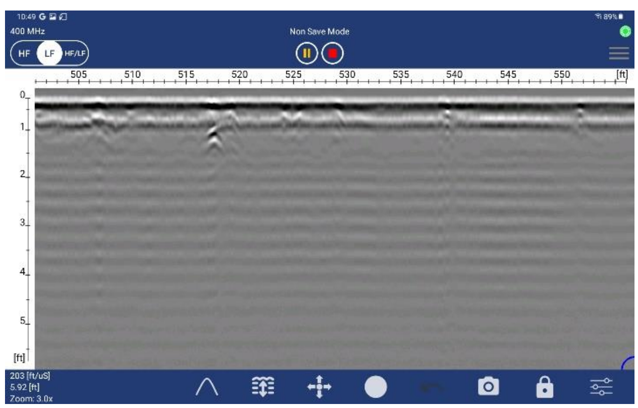
Data screenshot of a scan below the cracked rock.



Data screenshot of a scan over a rock visible on the surface of the road.



Data screenshot of what the scan looks like leading up and onto the area with the crack in the rock.



Data screenshot of normal scan through the area above the rocky area with the crack in the ground.

CLOSING

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GPRS appreciates the opportunity to offer our services, and we look forward to continuing to work with you on future projects. Please feel free to contact us for additional information or with any questions you may have regarding this report.

Signed,

Hunter Polley
Project Manager —Central Region (Denver)

GPRS SUBSURFACE SCANNING SOLUTIONS

Direct: 303.941.5195

Hunter.polley@gprsinc.com

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Summary of Scanning for Subsurface Voids

Prepared For: Trihydro

Prepared By:
Ryan Shannon
ryan.shannon@gprsinc.com
Area Manager-Colorado & MT/WY
303.913.8630

June 2, 2022

June 2, 2022

Trihydro
Attn: Tyrel Hulet, P.E.
Site: 36.957698238, -104.342080576 - Raton, NM

We appreciate the opportunity to provide this report for our work completed on May 26, 2022.

PURPOSE

The purpose of the project was to search for subsurface voids that may be present within the scanned areas using Frequency Domain Electromagnetic Induction (EMI) equipment. The scope of work consisted of an area of road measuring approximately 775' long by 20' wide. Client discovered crack in road located potentially over former underground mine in area.

EQUIPMENT

- **Frequency Domain Electromagnetic Induction (EMI)**. The EMI is moved over the surface without coming in contact with the surface so it is not affected by the terrain. However, EMI results are affected by surface features including vehicles, reinforced concrete, and buildings and will not be used in the vicinity of above-ground obstructions. Data is displayed on a control unit indicating the conductivity of the earth or buried objects. The data is post-processed and displayed in a color-coded contour map which shows relative changes in conductivity. This contour map will be provided by GPRS for interpretation by the client. For more information, please visit: Link

PROCESS

The process begins by using EMI equipment to collect scans throughout the area. The area was scanned with a scan spacing of approximately 5'. The EMI data is then processed to identify potential "hot spots" or areas of stronger reaction for potential further investigation and displayed on a heat map. Relevant scan examples were saved and will be provided in this report.

LIMITATIONS

Please keep in mind that there are limitations to any subsurface investigation. The equipment may not achieve maximum effectiveness due to soil conditions, above ground obstructions, reinforced concrete, and a variety of other factors. No subsurface investigation or equipment can provide a complete image of what lies below. Our results should always be used in conjunction with as many methods as possible including consulting existing plans and drawings, exploratory excavation or potholing, visual inspection of above-ground features, and utilization of services such as One Call/811.

Void mapping is not a definitive process. Therefore, there may be false positives in our findings. There also may be voids that are not able to be detected for a number of reasons.

FINDINGS

Based on the areas scanned, potential "hot spots" or stronger reactions were found within the areas shown in the supporting photos, data, and site map provided. The following pages will provide further explanation of the findings.

In addition, the Google Earth overlay used to display the heat map is not lining up with GPS coordinates used to capture data causing a slight shift of the heat map over the road scanned. However, GPS coordinates are correct.

Prepared for: Trihydro
Prepared By: Ryan Shannon
Date of Scanning: 5/26/2022

Terms and Conditions
GPRS does not provide land survey or civil engineering data collection or documentation. This is provided as a reference map of the field markings and is not survey-grade.

36.957698238, -104.342080576 - Raton, NM

Prepared by:
GPRS

Prepared for: Trihydro
Prepared By: Ryan Shannon
Date of Scanning: 5/26/2022

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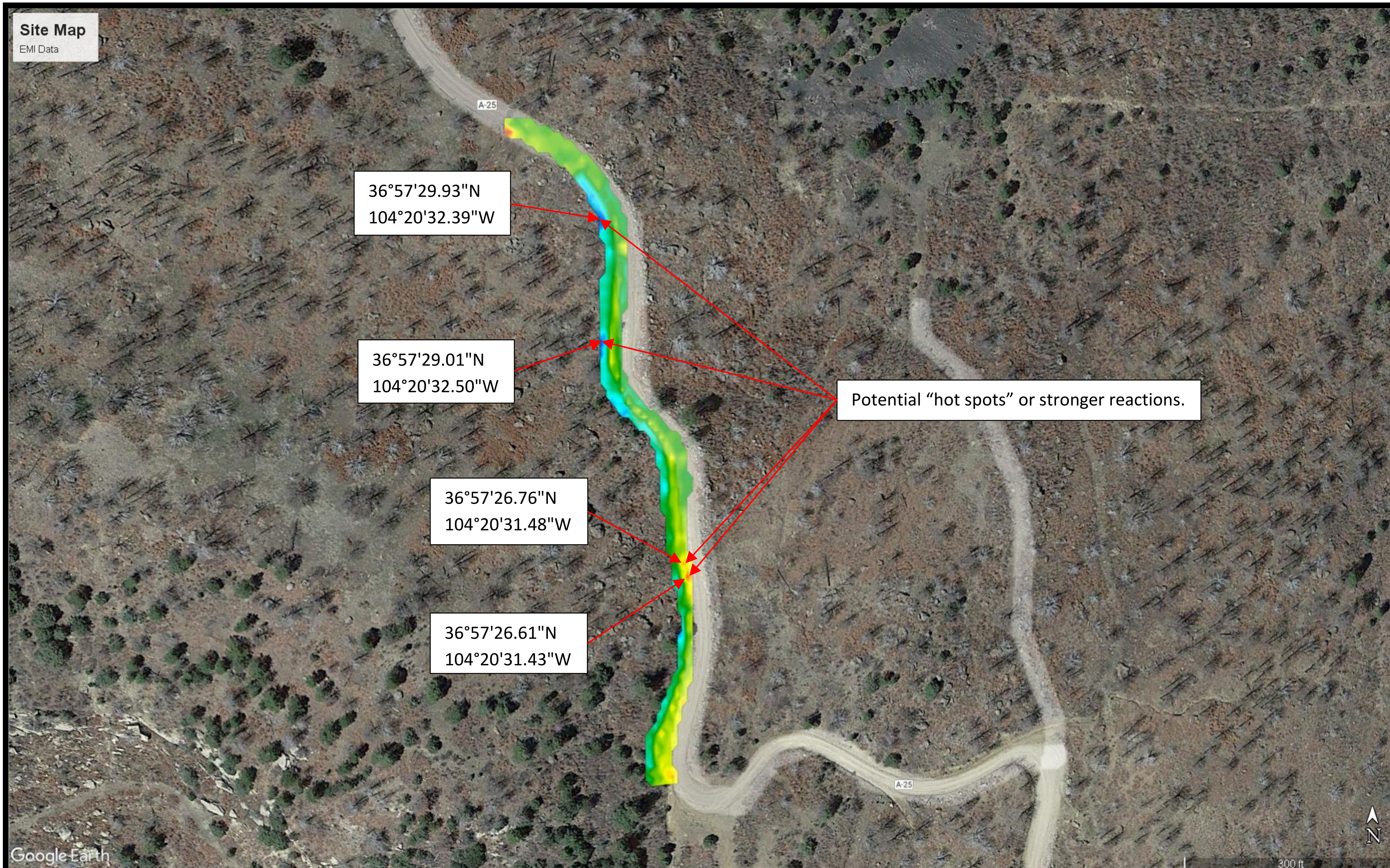
36.957698238, -104.342080576 - Raton, NM

Prepared by:



Prepared for: Trihydro
Prepared By: Ryan Shannon
Date of Scanning: 5/26/2022

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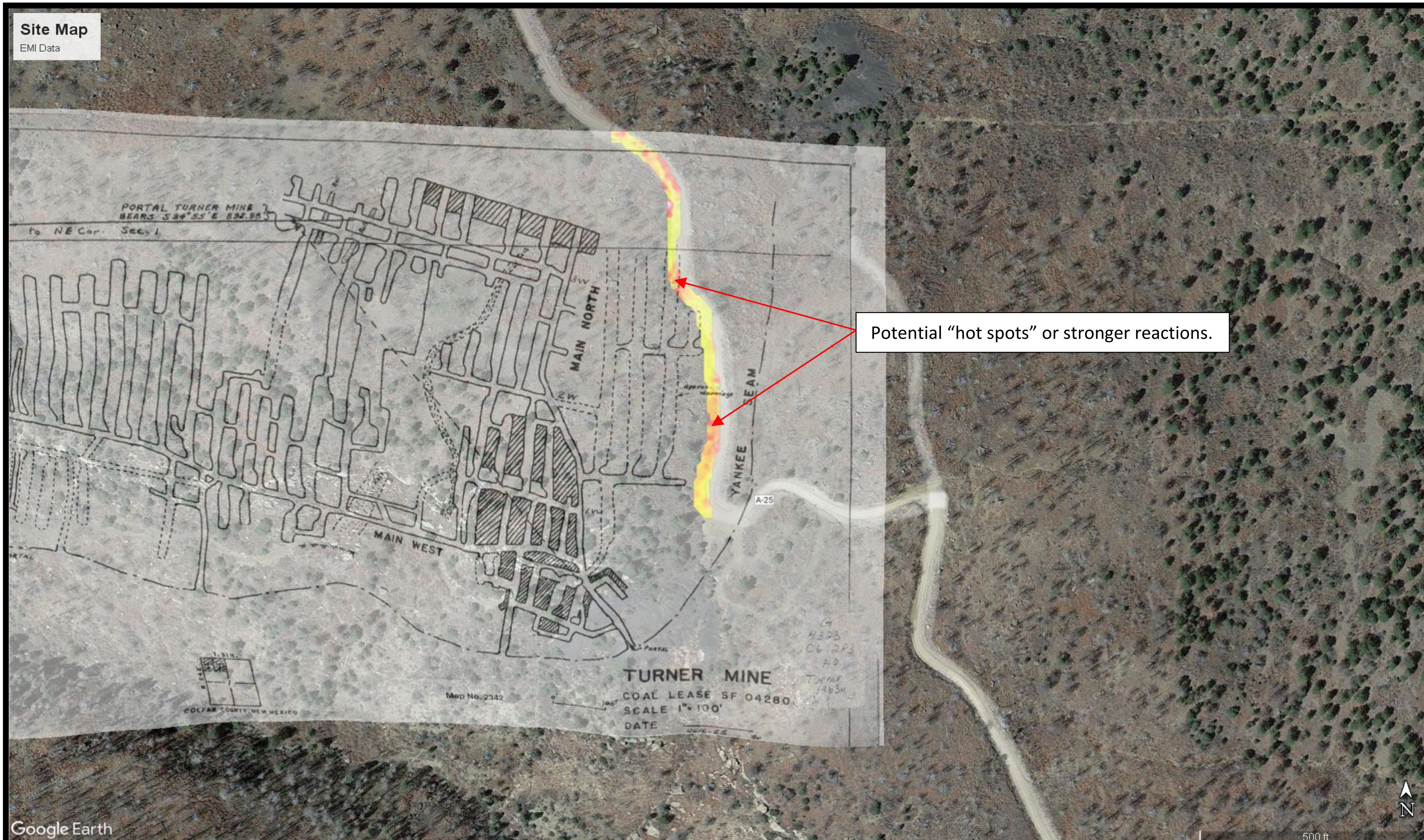
Prepared by: GPRS



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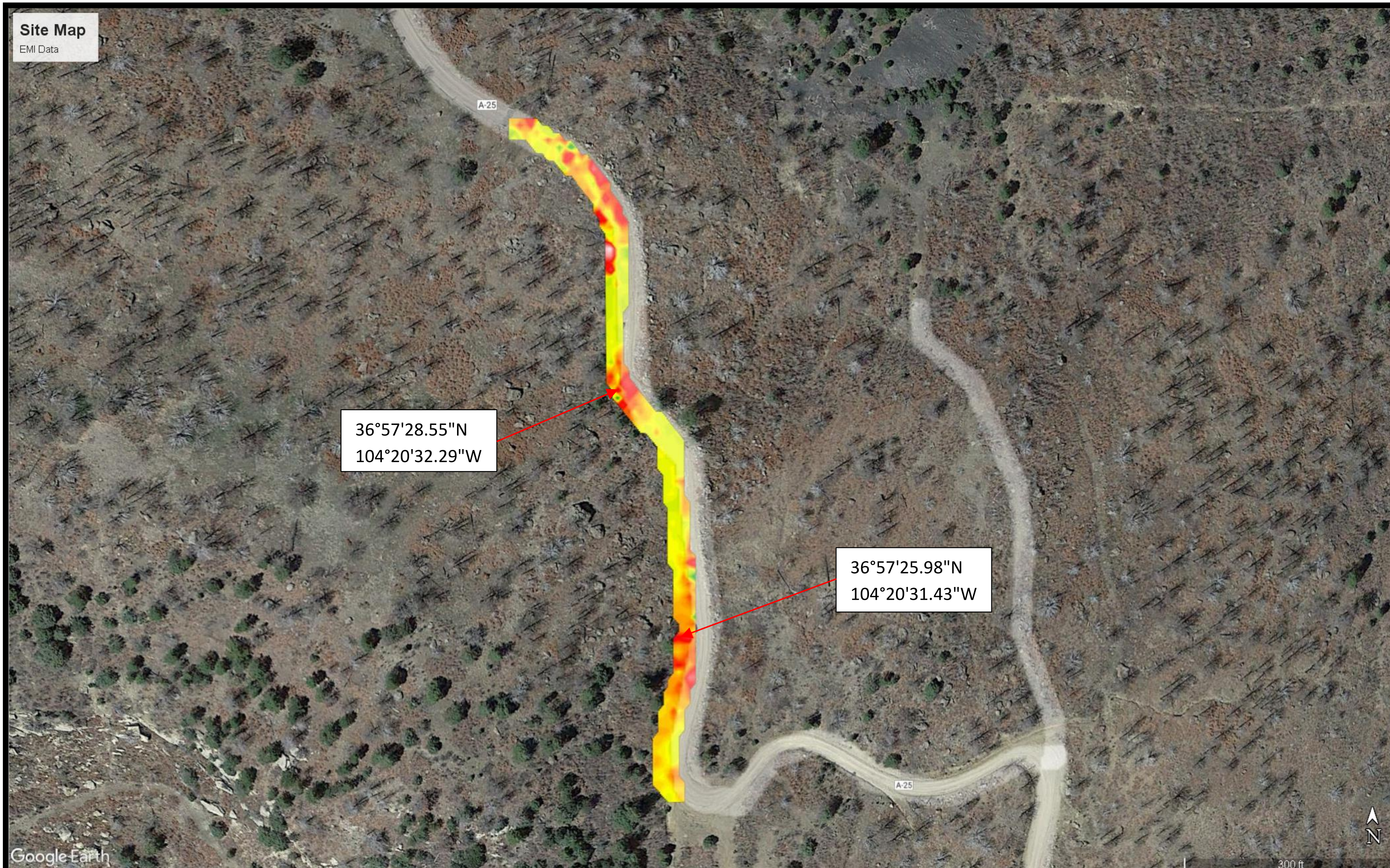
Prepared by: GPRS



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36.957698238, -104.342080576 - Raton, NM

Prepared by:

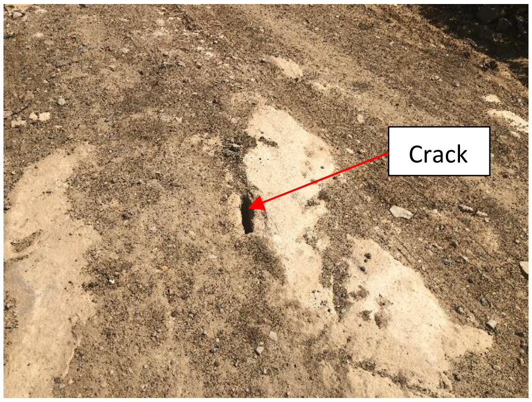

Photo of scan area. Photo displays crack discovered by client.


Photo of scan area. Start of scan area at cattle guard.


Photo of scan area. Section of road after first bend following cattle guard.

Site Photos	36.957698238, -104.342080576 - Raton, NM	GPRS


Photo of scan area. Section of road following second bend and containing crack discovered by client.


Photo of scan area. Last section leading to end of scan area at switchback.

Site Photos	36.957698238, -104.342080576 - Raton, NM	GPRS

CLOSING

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Signed,

Ryan Shannon
Area Manager—Colorado & MT/WY

Direct: 303.913.8630

ryan.shannon@gprsinc.com

www.gprsinc.com

APPENDIX B

BCI REPORT

BAT CONSERVATION INTERNATIONAL

TO:	Lloyd Moiola Environmental Manager New Mexico EMNRD Santa Fe, New Mexico	Laurence D'Alessandro Project Manager New Mexico EMNRD Albuquerque, New Mexico
FROM:	Subterranean Team, Bat Conservation International Dillon Metcalfe Subterranean Specialist Flagstaff, Arizona	 Shawn Thomas Subterranean Team Manager Olympia, Washington
SUBJECT:	Report on Yankee Canyon Abandoned Mine Bat Surveys	
SURVEY DATES:	November 17-18, 2021	

OVERVIEW:

This biological survey project assessed abandoned mines in Yankee Canyon, located on the flanks of Horse Mesa, east of Raton, New Mexico. All sites were surveyed by Bat Conservation International (BCI) staff following standardized protocols and safety procedures for providing subterranean mapping, biological data, and closure recommendations. Mapping efforts focused on accessible workings to determine proximity to road A-25 and a known subsidence in the middle of the roadway. The field project resulted in bat surveys being conducted on two distinct features, comprising two openings to the surface (Figure 1, Table 1). Bat habitat assessments and closure recommendations are provided for all features. A survey summary, full survey results, and a discussion of road A-25 can be referenced on the following pages.

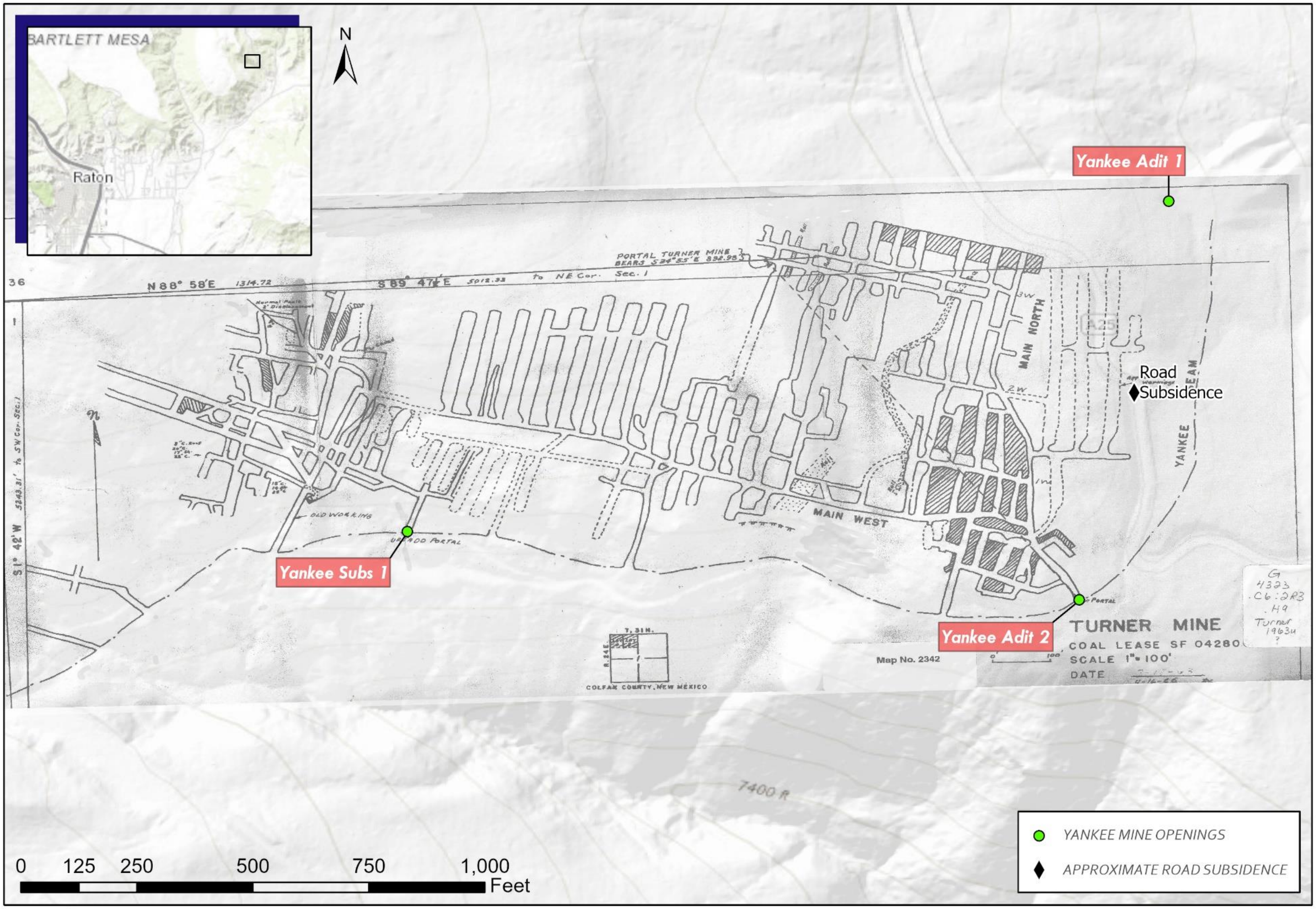
ACKNOWLEDGEMENTS:

BCI wishes to thank Lloyd Moiola for initiating the project and for providing the scope of work and site inventory descriptions. Special thanks to Laurence D'Alessandro for providing on-site navigation, assistance locating features, and serving in the surface safety role during field work. Additional thanks to Yeny Maestas, ENMRD, for joining the crew in the field.

All surveys conducted by BCI Subterranean Team staff: Dillon Metcalfe and Bill Burger. This report was authored by Dillon Metcalfe.

Report and photos submitted February 18, 2021.

BCI FIELD SURVEYS: YANKEE MINE GEOREFERENCE



BAT CONSERVATION INTERNATIONAL

Bureau of Land Management, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS, Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, EPA, USDA

Figure 1: Overview Map of Project Area and Features Surveyed

Table 1. Summary of bat survey results and closure recommendations.

Feature[1]	**Closure Recommendation**[2]	**Live Bats**[3]	**Bat Sign**	**Roost Function**	**Bat Habitat**
Yankee Adit VanLaten01	BCWS	3 COTO	none	hibernaculum	Good
Yankee Adit VanLaten02	DCWS	none	none	none	Moderate

[1]Feature: A distinct feature may consist of a single opening, multiple openings interconnected via underground workings, or closely related surface workings. In the "Feature" column, distinct features are separated by solid lines, and associated openings of a feature are separated by dashed lines. A feature contains shared biological and habitat characteristics and is therefore described by a single survey, whereas closure recommendations are unique to each opening.

[2]Closure recommendations:

Bat-compatible Closures
BCAT – bat-compatible closure, any time
BCCS – bat-compatible closure, cold season
BCWS – bat-compatible closure, warm season
CM – closure modification

No Action
LAI – leave as is

Destructive Closures
DCAT – destructive closure, any time
DCWS – destructive closure, warm season

Other Closure Type
AC – airflow closure

[3]Bat species codes: COTO – Townsend's big-eared bat (*Corynorhinus townsendii*)

SECTION 1: SURVEY SUMMARY

BIOLOGICAL SURVEY SUMMARY:

Biological surveys are focused on subterranean habitat, with a primary emphasis on bat use. Surveys attempt to identify bat species present, document other bat sign (e.g., guano, insect parts, roost staining), and determine roost function of the site. Additionally, surveys document other wildlife use of features, evident by live animals, scat, nests, etc. All bat and other wildlife observations inform habitat assessments and closure recommendations.

Bat Use:

Two distinct features[1] received comprehensive biological surveys. Both of these features offered some level of subterranean habitat with potential for bat use. One feature contained three hibernating bats. No other bat sign was observed.

Other Wildlife Use:

Other wildlife sign consisted of a small amount of packrat scat in VanLaten 2.

BAT HABITAT ASSESSMENT SUMMARY:

Bat habitat assessments are determined based on observed bats and bat sign, along with physical characteristics of the site such as complexity and extensiveness of workings, portal size and obstructions, ceiling textures that bats select for, hydrological activity (such as seasonal flooding) that may preclude bat use, and any additional observations that may influence bat use of the site. A bat habitat assessment is applied to each distinct AML feature, which may include multiple openings. See Appendix 2 for additional details on assessment classifications. Bat habitat assessments for this project are summarized in Table 2.

Table 2. Bat habitat assessments for distinct AML features surveyed.

Bat Habitat Assessment	# Features
None	0
Poor	0
Marginal	0
Moderate	1
Good	1
Excellent	0
Unknown	0

[1] A distinct feature may consist of a single opening, multiple openings interconnected via underground workings, or closely related surface workings. Each distinct feature, including associated openings, contains shared biological and habitat characteristics and is therefore described by a single survey.

CLOSURE RECOMMENDATION SUMMARY:
Closure recommendations generally fall into bat-friendly or destructive closure categories and include a seasonal component that recommends the closure to occur either during the warm season, cold season, or at any time. A closure recommendation is provided for each individual opening of an AML feature. See Appendix 3 for additional details on recommendation classifications and Appendix 4 for guidance on conducting exclusion prior to closure. Closure recommendations for this project are summarized in Table 3.

Table 3. Closure recommendations for AML openings surveyed.

Closure Recommendation	Code	# Openings
Bat-compatible Closure, Any Time	BCAT	0
Bat-compatible Closure, Cold Season	BCCS	0
Bat-compatible Closure, Warm Season	BCWS	1
Other Wildlife-compatible Closure	OWC	0
Destructive Closure, Any Time	DCAT	0
Destructive Closure, Warm Season	DCWS	1
Leave As Is	LAI	0
Closure Modification	CM	0
Airflow Closure	AC	0

APPENDICES:
Appendix 1 contains selected photos from this survey project. Appendix 2 describes bat habitat assessment classifications. Appendix 3 describes closure recommendation classifications. Appendix 4 provides guidance on bat exclusion methods when recommended for destructive closures.

SECTION 2: FULL SURVEY RESULTS

Unless otherwise noted, all features are driven in moderate- to good-quality rock (qualitative safety assessment), contain good air*, and exhibit minimal signs of post-mining human disturbance. All feature locations are listed as latitude and longitude (decimal degrees) in the WGS84 datum.

* Good air is defined as no alarm sounding on the Altair 4x Multi-gas Detector carried during all surveys. The detector measures four gases (oxygen, carbon monoxide, hydrogen sulfide, methane) and alarms for gas levels that fall outside of safe thresholds.

Feature: Yankee Adit VanLaten01
Location: 36.95887065, -104.34187169
Date: November 17, 2021
Observations: This feature is a straight adit with a short crosscut that leads to another crosscut parallel to the main adit. Total workings are 457’ and together form a capitol “H” shape in plan view. The main adit is straight and wide and is 274’ long to where it ends in collapse. It is very likely that this feature connected to the known historical workings of the Yankee Mine prior to this collapse. There are plentiful timber stulls fixed with intermittent porcelain knobs for electrical wire. 73’ from the portal, a crosscut is driven 32’ to the right, where it intersects another crosscut that is driven 89’ in one direction and 63’ in another. Three hibernating Townsend’s big-eared bats were observed in various parts of the mine. No other wildlife sign was observed.
Bat Habitat: Good
Closure Recommendation: Bat-compatible Closure, Warm Season (BCWS)

Feature: Yankee Adit VanLaten02
Location: 36.95651851, -104.34240019
Date: November 17, 2021
Observations: This feature is a backfilled adit that has subsided. It can be identified by a piece of railroad rail that is stuck in the backfill material. The open subsidence is 2’ wide and 1.5’ high. 112’ of workings were surveyed. The adit is driven straight for 55’, where an unstable, collapsing area prevented further passage. A very large block of sandstone is precariously balanced on a single old stull, and passage would not be possible without pressing against the block in order to slide past. 29’ from the face, a drift is driven to the left for 33’ before ending in collapse.
Bat Habitat: Moderate
Closure Recommendation: Destructive Closure, Warm Season with exclusion.

Discussion of county road A-25: Attempts were made to find a connection between the subsidence and either of the accessible portals. Neither Yankee Adit 01 or Yankee Adit 02 connected to the subsidence via accessible subterranean workings. Both features ended in collapse before the large, historically documented workings could be reached. It is likely that the road overlays some historical excavation and that further subsidence is possible. Given the known extent of the historical mine, the road will likely need to be rerouted to the east and north. No major topographical obstacles appear to prevent this reroute, but extensive archeological resources in the vicinity of the portal should be considered before construction. The georeferenced map provided in Figure 1 of this report suggests that rerouting the road anywhere to the west would risk overlaying the historical workings that honeycomb the mesa.

APPENDIX 1

Selected photos from the field project. The full set of photos from all features was provided in digital form with this report.

Yankee Adit 01: Dillon examines the back for bats.
BCI Photo by Bill Burger


Yankee Adit 01: A Townsend’s big-eared bat roosts on the ribs.
BCI Photo by Bill Burger


Yankee Adit 01: The coal seam is visible along the ribs.
BCI Photo by Bill Burger

Yankee Adit 02: The dangerous section that prohibited passage. Note the large, rectangular white block balanced on a single old timber stull.
BCI Photo by Bill Burger

Yankee Adit 02: Another view of the dangerous blockage.
BCI Photo by Bill Burger

Yankee Adit 01: Much of the feature required crawling squeezes to negotiate.
BCI Photo by Bill Burger

Yankee Adit 01: Dillon quietly crawls under a hibernating bat.
BCI Photo by Bill Burger

APPENDIX 2

Bat Habitat Assessment Classifications

Bat habitat is assessed for each feature surveyed and describes the value of that feature for bat use. Determining bat habitat is the primary objective of surveys conducted by the BCI Subterranean Program. Survey of a feature results in seven possible bat habitat classifications: excellent, good, moderate, marginal, poor, no habitat, or unknown. Each of these classifications are described below.

Excellent Bat Habitat

Description

Excellent bat habitat is very rare amongst features surveyed. For a feature to be assessed as having excellent habitat, significant bat use, usually by colonies, must be documented. Typically, this occurs when a large single species roost (>20 bats) is identified using the feature for warm season aggregation, usually in conjunction with substantial guano piles. Bats present in lower numbers but representing multi-species use of three or more species also warrants an assessment of excellent habitat. Bats need not be present to identify excellent habitat, as obvious bat sign such as large guano piles, heavily scattered guano along flyways, and roost staining on ceilings are indicators of significant bat use. Major winter use by bats cannot be confirmed during warm season surveys, though features that exhibit cold temperatures, airflow, and a high diversity of microclimates and roosting habitat can be identified as sites with good potential for serving as hibernacula. Features offering excellent bat habitat usually exhibit striking internal complexity, with extensive workings and possibly multiple levels. Due to the extensiveness of underground workings, these features nearly always offer high quality rock habitat. Exceptions, however, include small features used as maternity sites. Feature stability should be good, with little concern for future collapse that could result in loss of the roost.

Closure Recommendation

Features with excellent bat habitat should nearly always be recommended for protection (exceptions include imminent collapse or other major safety hazards). To minimize disturbance while bats are using the feature for a critical life cycle phase, bat-friendly closures should occur during the opposite season of primary use. For example, closure of a feature that hosts a maternity colony should occur during the cold season, and closure of a feature that serves as a hibernaculum should occur during the warm season. For features with multiple entrances, closures should protect all openings that are either used for bat access or necessary to preserve airflow patterns.

Good Bat Habitat

Description

Good bat habitat is represented by features that contain clear signs of persistent bat use but do not exhibit the striking evidence of significant use by bat colonies. These features often support use by one or two species of bats that use the site as a day roost or night roost. Bat sign such as guano, either scattered or in small piles, and insect parts are common in these features. The internal workings usually exhibit moderate complexity, with rock habitat quality that meets the specific needs of day or night roosting bats, such as domes, drill holes, and/or a heavily featured back. Feature stability should be good, with little concern for future collapse that could result in loss of the roost.

Closure Recommendation

Features with good bat habitat should nearly always be recommended for protection (exceptions include imminent collapse or other major safety hazards). Bat-friendly closures can usually occur at any time of the year, as bat use of these sites is persistent but dispersed and does not represent significant use for warm season maternity colony aggregation or cold season hibernation. For features with multiple entrances, closures should protect all openings that are either used for bat access or necessary to preserve airflow patterns.

Moderate Bat Habitat

Description

Moderate bat habitat generally refers to features that exhibit some signs of minor bat use or have potential for bat use due to the level of complexity and/or stable microclimate offered within. Moderate habitat features are often occupied by one or two bats, possibly on a seasonal nature, but will not display any signs of significant bat use. Guano, if present, will be lightly scattered, or in no more than a few very small piles representative of solitary bats of a single species. Insect parts may also be present, indicating night roosting. Bat sign may also be completely absent from these features at the time of survey, either due to extremely limited bat use, suspected winter use that cannot be detected during a warm season survey, or feature conditions such as flooding that may cover or destroy evidence of bat use. Complexity of the feature will range from simple, if combined with other signs of bat use, to moderately complex. Feature stability should be relatively stable, and rock habitat quality should offer some level of suitable roosting surface.

Closure Recommendation

Features with moderate bat habitat fall into the "grey area" where bat use is not necessarily prominent enough to immediately warrant a protective closure, yet the possibility for increased future bat use exists. Generally, a bat-friendly closure should be recommended for features with moderate habitat in order to maintain a conservative approach to habitat protection. Furthermore, the context of the feature relative to the surrounding landscape may elevate its importance if few other suitable habitat options are available. Scenarios that may call for destructive closure recommendations on features that meet the criteria for moderate habitat include unstable internal conditions that suggest future collapse/destruction of the feature or areas in which the feature is eclipsed by numerous other features with superior habitat. If a destructive closure is recommended, it must be accompanied by bat exclusion prior to closure.

Marginal Bat Habitat

Description

Features designated marginal bat habitat generally lack bats and bat sign. Less commonly, these features may exhibit signs of very minor, infrequent use. A single bat may be present, but there may be no accompanying signs that would allow detection if the bat was absent. Guano and insect parts, if present, will be very sparsely scattered and require diligence for detection. Complexity of the feature will always be simple, with no substantial workings; however, these features are usually extensive enough to include a dark zone, and the entire feature is not visible from the portal or collar. Marginal features are often short, simple adits or blind and bald shafts. Feature stability can be stable, but often poor rock conditions contribute to marginal habitat. Rock habitat quality will generally be poor to fair, with less than ideal roosting surfaces.

Closure Recommendation

Features with marginal bat habitat are almost invariably recommended for destructive closure due to these features lacking bat sign and/or containing unstable conditions that threaten collapse. Given the possibility for bats to be present in these features, exclusion is required prior to closures occurring in the warm season when bats are active. In rare circumstances, a protective closure may be warranted to allow for the possibility of future bat use, especially if the feature represents one of the only subterranean habitat options in the area.

Poor Bat Habitat

Description

Features classified as poor bat habitat tend to be very small prospects that exhibit no signs of bat use. While these features offer some level of subterranean habitat, the workings are so limited as to offer no true dark zone and no area of stable subterranean microclimate. Usually, the entire feature will be visible from the portal or collar. These features are so small that structural stability is often quite good, but they may also be in a state of collapse. Rock habitat quality can range the entire spectrum, but this assessment is largely irrelevant in such small features that offer little physical area from which bats can select roosting spots that have a stable microclimate.

Closure Recommendation

Features with poor bat habitat are recommended for destructive closure. Due to the lack of bat sign or potential for future bat use, a "DCAT" recommendation is usually warranted on these features.

No Bat Habitat

Description

Assessing a feature as containing no bat habitat means no subterranean habitat is available. No underground workings are present at all, and the feature would present no option for bats to roost in subterranean environments. This scenario occurs for features that are totally collapsed, prospect scrapes, entirely and permanently flooded, or some other similar circumstance. This assessment is also appropriate for portals that are almost entirely sloughed closed and/or overgrown with vegetation such that bats would be unable to access the workings.

Closure Recommendation

With no subterranean component and thus no bat habitat, a "DCAT" recommendation is always warranted. For some features, though, especially those that contain no inherent hazard, a "Leave As Is" recommendation may be most appropriate. This recommendation is most applicable to prospect scrapes and pits that contain no headwall and may be largely overgrown.

Unknown Bat Habitat

Description

If an internal survey cannot be conducted, and underground workings are likely to exist based on observations from the surface, then bat habitat cannot be assessed. This usually occurs when the feature is not accessible due to safety concerns (e.g., wildlife hazards, rock or timber hazards) at the portal or collar. Often, looking into the feature from outside confirms that underground workings are present, though inaccessible. An unknown bat habitat assessment may also be appropriate for some partial internal surveys, when a survey is terminated underground due to safety concerns. In these instances, though, if extensive workings and/or bats and bat sign are observed prior to terminating the survey, then a higher bat habitat classification and feature protection are warranted.

Closure Recommendation

Closures of features with unknown bat habitat should follow conservative recommendations to minimize the possibility of destroying potentially important bat roosts. When possible, bat-friendly closures should be recommended for these features. In cases where destructive closures are more appropriate (e.g., collapse of feature is imminent), exclusion is required prior to closures occurring in the warm season when bats are active.

APPENDIX 3

Closure Recommendation Classifications

Closure recommendations are assigned to each opening of a distinct feature surveyed and prescribe the appropriate remediation strategy for the site. Bat use, other wildlife use, feature stability, and overall nature of the workings are considered when determining the closure recommendations. Survey of a feature usually results in recommendation of a bat-compatible closure or destructive closure for each opening, with a seasonal component to advise suitable timing of the closure. In some cases, openings may warrant other wildlife-friendly closures or recommendation of no action (leave as is). Each of these classifications are described below.

Bat-compatible Closures

Bat-compatible closures are recommended for openings to features that contain bats / bat sign and/or exhibit characteristics that indicate high potential for bat use. These features warrant protective closures to maintain the bat habitat within and allow for continued bat use. Bat-compatible closures include a variety of methods that fall on a spectrum of high to low compatibility. No closure method is perfect for all bat species, but generally, gates designed to comply with bat-compatible specifications are preferred to 1) minimize the potential of disrupting current use patterns and 2) promote long-term access for bats and other wildlife. For openings that are unstable or present access challenges, construction of a standard bat gate may not be possible. In these instances, use of alternative methods such as culverts or cable nets may be the most feasible method; while these closure types are not ideal for bats and other wildlife, they may still facilitate moderate levels of access and habitat use and therefore present a suitable alternative to total habitat loss.

Three seasonal designations are used to recommend appropriate timing of bat-friendly closures:

- BCAT (Bat-compatible Closure, Any Time): "Any time" bat closures are recommended for openings to features in which overall bat use is relatively minor or not confined to any single season.

- BCCS (Bat-compatible Closure, Cold Season): Cold season bat closures are recommended for openings to features that display significant warm season use, typically by a maternity colony of bats. Closure is recommended to occur during the cold season to avoid disturbance of bat colonies, which could potentially lead to abandonment of the site.

- BCWS (Bat-compatible Closure, Warm Season): Warm season bat closures are recommended for openings to features that are documented as hibernacula or exhibit characteristics that indicate high potential for significant cold season use by hibernating bats. Closure is recommended to occur during the warm season to avoid disturbance of hibernating bats, which could potentially lead to bats arousing and burning critical energy reserves.

Airflow Closures

Airflow closures may be recommended for secondary openings to features with multiple openings that access habitat warranting protection. Independent, secondary openings often contribute to the microclimate and habitat suitability of the underground workings via air exchange but may not serve as important access points for wildlife. In these cases, it is appropriate to close these secondary openings in a way to maintain air exchange without preserving access to wildlife.

Other Wildlife-compatible Closures

Protection may also be recommended for openings to features that display significant use by wildlife other than, or in addition to, bats. These closure recommendations are relatively rare, and closure methods are dependent on type of wildlife use. Protection of features may be warranted for use by wildlife including, but not limited to, birds (e.g., owls, vultures), mammals (e.g., cats, foxes, porcupines, ringtails), and reptiles/amphibians (e.g., salamanders).

Closure Modifications

Closure modifications are recommended for existing closures such as bat gates or backfills that do not adequately protect or maintain habitat provided by the feature. In these cases, a modification to the existing closure is recommended to improve wildlife access to habitat assessed at the time of survey. Closure modifications are recommended to provide access to previously inaccessible habitat or to facilitate increased use of existing habitat. Seasonality is also considered in closure modification recommendations to advise suitable timing of the modification.

Destructive Closures

Destructive closures are recommended for openings to features that either offer no bat habitat, contain no evidence of bat use, or exhibit only minor, insignificant bat use. In some cases, destructive closures may also be recommended for secondary openings to features that are protected through bat-compatible closure of primary openings used for wildlife access. Two destructive closure designations are used to recommend appropriate measures based on possible bat use:

- DCAT (Destructive Closure, Any Time): These openings access features that exhibit no signs of bat use or potential for bats to be present and can be destructively closed without conducting exclusion, during any season. This recommendation may also be applied to secondary openings to features protected for wildlife habitat, provided that these openings do not serve any critical function in maintaining wildlife access or suitable habitat conditions.

- DCWS (Destructive Closure, Warm Season): These openings access features that either exhibit signs of minor, insignificant bat use or have the potential for bats to be present during destructive closure. In some cases, other wildlife such as birds may be present, and these animals should also be excluded; alternatively, closure with bat exclusion may be timed for after the nesting season when birds are no longer using the feature. Using appropriate exclusion techniques on the features prior to closure is critical. Exclusion needs to be done during the warm season when bats are active and will be able to escape. See Appendix 5 and refer to “Managing Abandoned Mines for Bats,” published by Bat Conservation International, for guidance on exclusion techniques.

No Action

"Leave as is" treatments are recommended for features that present no inherent safety concerns. A feature with this recommendation is generally either a prospect scrape/trench with no subterranean component, or the portal has completely collapsed, making the feature inaccessible.

APPENDIX 4

Exclusion Guidance as Excerpted from BCI's "Managing Abandoned Mines for Bats"

Timing of Exclusions

The exact timing of exclusions and site closures is best determined locally, given the variability in types of use by different species. As a general rule, bats must be active for exclusions to be effective, so all exclusions should be conducted outside of hibernation season. In general:

- The best time to implement exclusions and portal closures is during late summer or early fall, after cessation of maternity activities and before the onset of hibernation.
- Early-fall closures will best ensure a window for bats to find alternate hibernacula and will give females a full spring season to locate alternate maternity sites.

Exclusions for Destructive Closures

Regardless of the reason for a destructive closure of known or potential bat roosts, steps must be taken to ensure significant bat colonies are not destroyed as a direct result of closure activities. Managers should include adequate exclusions as a routine part of mine reclamation programs to minimize the risk of entombing bats in closed workings. Further, closures should be conducted immediately following exclusion to limit the chance of bats becoming reestablished in the mine. In general, these two guidelines can help determine whether exclusions should be conducted and how intense the exclusion effort should be.

Exclusions Not Required: Exclusions are generally not required if a mine does not offer potential bat habitat, as mutually agreed upon by all partners involved in the mine closure project.

Standard Exclusions: In general, exclusions are recommended at all mines that represent habitat for bats. Given the ephemeral and episodic use of some roosts, it is prudent to err on the side of caution and conduct standard exclusions efforts, especially if significant time has elapsed since biological assessments were conducted.

The use of one-inch mesh material (e.g., chicken wire, polypropylene or similar material) is most often used to exclude bats from a mine. Lighter-weight material may be used for remote mines that require physically transporting the material over long distances or rough terrain. Although this material is very effective for excluding bats, it may also entangle bats and other wildlife. Managers may need to develop a plan to periodically check exclusion materials at sites with large bat colonies or high use by other wildlife to prevent loss of entangled bats, amphibians, reptiles or birds.

Exclusion materials should be maintained for at least three nights prior to portal closure at mines that provide habitat and where little or no bat use has been detected. Simultaneously covering all external openings with exclusion materials and leaving it in place for at least one week is an effective method for excluding most bat species from roosts. Difficulties in navigating through exclusion materials should cause bats to seek alternate roosts rather than continuing to access the mine through the wire.

For most species, simply spreading exclusion materials across portals will be sufficient to allow bats to exit a mine while effectively discouraging their return. However, not all bats in all roosts across all landscapes will respond in an identical manner. As a general rule, smaller colonies in areas where roosts are abundant tend to quickly abandon roosts after exclusion materials are installed. For example, exclusion materials left in place for three to five nights will usually cause small colonies of Townsend's big-eared bat roosting in small mines in Nevada to abandon the roosts.

END OF SURVEY REPORT

APPENDIX C

PHOTOS

Photo 1. Subsidence feature found by Colfax County Road Department

Photo 2. County Road A-25

Photo 3. GPRS employee performing ground penetrating radar (GPR) inspection.

Photo 4. GPRS setting up for GPR scanning.

Photo 5. EMI inspection scanner.

Photo 6. GPRS employee GPR inspections.

Photo 7. GPRS employee walking grid pattern with EMI scanner.

Photo 8. GPRS employee walking grid pattern with EMI scanner.

Photo 9. GPRS employee walking grid pattern in County Road A-25.

Photo 10. Logging subsidence features in County Road A-25 with GPS unit.

Photo 11. Logging subsidence features in County Road A-25 with GPS unit.

Photo 12. Logging subsidence features in County Road A-25 with GPS unit.

Photo 13. Logging features in County Road A-25 with GPS unit.

Photo 14. GPRS marking scans made with GPR units.

Photo 15. GPRS marking scans made with GPR units.

Photo 16. Adit A-1

Photo 17. Adit A-1.

Photo 18. Adit A-3.

Photo 19. Mine structures near Adit A-3.

Photo 20. Mine structures by Adit A-3.

Photo 21. Adit A-2.

Photo 22. Subsidence features in County Road A-25; February 16, 2022.

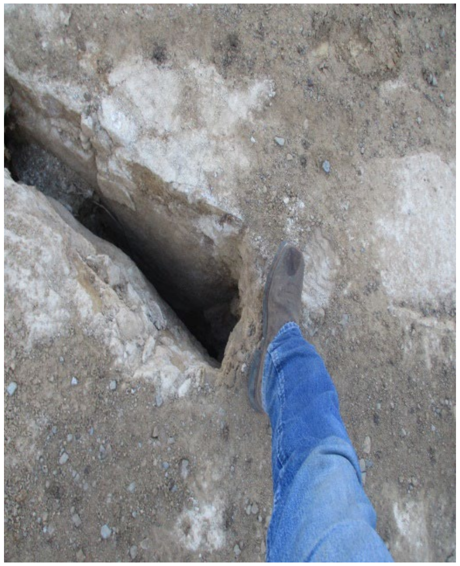


Photo 23. Largest subsidence feature in County Road A-25; February 16, 2022.

Photo 24. Largest subsidence feature in County Road A-25; February 16. 2022.

Photo 25. Subsidence features in County Road A-25; February 16, 2022.

APPENDIX D

COST ESTIMATES

APPENDIX D-1. POLYURETHANE FOAM AND BACKFILL CLOSURE COST ESTIMATE

Material Costs				
Item	**Quantity**	**Unit**	**Unit Price**	**Estimated Price**
EFS005C/Equivailent Polyurethane Foam (bagged)	10	CY	$ 298.00	$ 2,980.00
Crushed Base	121	CY	$ 55.00	$ 6,655.00
Geotextile (Non-woven, Geotex 601/equivalent)	3000	SF	$ 0.31	$ 930.23
			Materials Total	$ 10,565.23
Equipment and Labor Costs				
Item	**Quantity**[1]	**Unit**	**Unit Price**	**Estimated Price**
Motor Grader (Cat 140 or equivalent)	8	HR	$ 189.00	$ 1,512.00
Rubber Tire Backhoe	8	HR	$ 165.00	$ 1,320.00
End Dump Truck (8 CY)	16	HR	$ 150.00	$ 2,400.00
Transport Truck + Trailer	12	HR	$ 150.00	$ 1,800.00
Contractor Superintendent w/ Pickup	24	HR	$ 115.00	$ 2,760.00
Water Truck	8	HR	$ 150.00	$ 1,200.00
Smooth Drum Roller	8	HR	$ 158.00	$ 1,264.00
Laborer	24	HR	$ 65.00	$ 1,560.00
			Equipment and Labor Total	$ 13,816.00
			Total Cost	$ 24,381.23

Notes:
CY - cubic yards
HR - hour
SF - square feet
[1]Assumes a 8-hour workday

APPENDIX D-2. SUBSIDENCE DRILLING AND GROUTING

Proposed Drilling and Grouting Costs				
Material Costs				
Item	**Quantity**	**Unit**	**Unit Price**	**Estimated Price**
Grout	200	CY	$ 180.00	$ 36,000.00
			Materials Total	$ 36,000.00
Equipment and Labor Costs				
Item	**Quantity[1]**	**Unit**	**Unit Price**	**Estimated Price**
Rotary Drill Rig w/ Grout Injection System	125	HR	$ 500.00	$ 62,500.00
Transport Truck + Trailer	8	HR	$ 150.00	$ 1,200.00
Contractor Superintendent w/ Pickup	133	HR	$ 115.00	$ 15,295.00
Water Truck	125	HR	$ 150.00	$ 18,750.00
Grout Pump	42	HR	$ 220.00	$ 9,240.00
Concrete Truck	42	HR	$ 150.00	$ 6,300.00
Laborer	125	HR	$ 65.00	$ 8,125.00
Geologist	83	HR	$ 100.00	$ 8,300.00
Reporting	1	LS	$ 7,500.00	$ 7,500.00
			Equipment and Labor Total	$ 137,210.00
			Total Cost	$ 173,210.00

Supplemental Drilling and Grouting Costs				
Material Costs				
Item	**Quantity**	**Unit**	**Unit Price**	**Estimated Price**
Grout	50	CY	$ 180.00	$ 9,000.00
			Materials Total	$ 9,000.00
Equipment and Labor Costs				
Item	**Quantity[1]**	**Unit**	**Unit Price**	**Estimated Price**
Rotary Drill Rig w/ Grout Injection System	33	HR	$ 500.00	$ 16,500.00
Contractor Superintendent w/ Pickup	36	HR	$ 115.00	$ 4,140.00
Water Truck	33	HR	$ 150.00	$ 4,950.00
Grout Pump	14	HR	$ 220.00	$ 3,080.00
Concrete Truck	14	HR	$ 150.00	$ 2,100.00
Laborer	36	HR	$ 65.00	$ 2,340.00
Geologist	19	HR	$ 100.00	$ 1,900.00
			Equipment and Labor Total	$ 35,010.00
			Total Cost	$ 44,010.00

Notes:
CY - cubic yards
HR - hour
SF - square feet
[1]Assumes a 10-hour workday

APPENDIX D-3. BAT COMPATIBLE ADIT CLOSURE COST ESTIMATE

Material Costs				
Item	**Quantity**	**Unit**	**Unit Price**	**Estimated Price**
Polyurethane Foam (bagged)	4	CY	$ 298.00	$ 1,192.00
Non-shrink Grout (bagged)	24	EACH	$ 17.41	$ 417.84
24" Corrugated Metal Pipe	30	LF	$ 60.07	$ 1,801.98
Grate Closure	3	LS	$ 1,000.00	$ 3,000.00
			Materials Total	$ 6,411.82
Equipment and Labor Costs				
Item	**Quantity[1]**	**Unit**	**Unit Price**	**Estimated Price**
Site Access Improvements	1	LS	$ 2,000.00	$ 2,000.00
Excavator (John Deere 75G or equivalent)	36	HR	$ 140.00	$ 5,040.00
Transport Truck + Trailer	2	HR	$ 150.00	$ 300.00
Contractor Superintendent w/ Pickup	36	HR	$ 115.00	$ 4,140.00
Laborer	72	HR	$ 65.00	$ 4,680.00
			Equipment and Labor Total	$ 16,160.00
			Total Cost	$ 22,571.82

Notes:
CY - cubic yards
HR - hour
SF - square feet
[1]Assumes a 12-hour workday
Assumes 6ft by 6ft adit openings
Prices include closures for Adit: A-1, A-2, and A-3